SECURED STUDENT INFORMATION MANAGEMENT SYSTEM

HEMANILASHINII A/P THARMALINGAM

FACULTY OF INFORMATION SCIENCE & TECHNOLOGY

MULTIMEDIA UNIVERSITY

JULY 2024

SECURED STUDENT INFORMATION MANAGEMENT SYSTEM

BY

HEMANILASHINII A/P THARMALINGAM

THE PROJECT REPORT IS PREPARED FOR

FACULTY OF INFORMATION SCIENCE & TECHNOLOGY
MULTIMEDIA UNIVERSITY
IN PARTIAL FULFILLMENT
FOR

BACHELOR OF INFORMATION TECHNOLOGY
B.I.T. (HONS) SECURITY TECHNOLOGY

FACULTY OF INFORMATION SCIENCE & TECHNOLOGY

MULTIMEDIA UNIVERSITY

JULY 2024

DECLARATION

I hereby declare that the work has been done by myself and no portion of the work contained in this thesis has been submitted in support of any application for any other degree or qualification of this or any other university or institute of learning.

HEMANILASHINII A/P THARMALINGAM

Faculty of Information Science & Technology
Multimedia University

Submission Date: 7th July 2024
Submission Time:

ACKNOWLEDGEMENT

Firstly, I would like to express my gratitude to MS. Pa Pa Min, my supervisor who helped me to complete the project within the stipulated time. I was able to communicate at any time regarding the project details and thanks for spending her time to answer my questions. The guidance and support from madam were helpful throughout the project development. Besides that, I would like to thank my family, especially my mother for being there with me as moral support to deliver the project as good as possible.

Additionally, I would like to thank the Faculty of Information Science & Technology, Multimedia University for giving me the opportunity to conduct the final year project. Finally, thanks to my friends who helped answer some of the questions based on the project.

ABSTRACT

The student information management system plays an important role in educational institutions. This system is used to manage and organize valuable information related to students. The system addresses key aspects such as enrollment, academic records, financial details, subject management, and attendance class schedules, sending and receiving emails, creating and submitting assignments. The main users of this system are students, admin, and instructors. The system can be accessed based on their email address and the matching password whether the system brings to the instructor or student dashboard. Whereas for admin, they have their own URL to access all the necessary resources. The availability of the system must be user friendly, giving a convenient feeling to the users to use the system error free and easily navigate the functions and features.

The aim of this project is to provide a holistic solution for an effective and secured student information management system with securing information by leveraging technology to streamline administrative processes, students and instructor's activities while contributing to the success and growth of educational institutions.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS/ SYMBOLS

DFD	Data Flow Diagram
UML	Unified Modeling Language
SDLC	Software Development Life Cycle
FYP	Final Year Project
FIST	Faculty of Information Science & Technology
RBAC	Role Based Access Control
SSL	Secure Socket Layer
SQL	Structured Query Language
VPN	Virtual Private Network
RSA	Rivest, Shamir, Adleman Algorithm
TLS	Transport Layer Security
HTTPS	Hypertext Transfer Protocol Secure
LDA	Lightweight Directory Access Protocol
SAML	Security Assertion Markup Language
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
CA	Certificate Authority
PBKDF2	Password-Based Key Derivation Function 2
CSRF	Cross-Site Request Forgery

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Overview

The Student Information System is an application-based project which is a software-designed website to manage and organize student-related pieces of information in a single repository for the educational institution's purpose. This application is huge and usually includes types of elements to handle different aspects of student data, administration processes and academic staff in an education system. This system mainly focuses on students where they can access the enrollment page for registration of subjects and view the details about academic records to know their progress in studies. Students are also allowed to scan the attendance, view, and pay tuition fees on time. Apart from this the administrator manages the student user, financial details of a student, and maintains course information. Academic staff is one of the users of this system providing teaching and learning processes to the student and at the same time they are the main actors in collecting and gathering academic information after each course assessment and at the end giving the final output of the examination marks. A well-implemented system application enhances the interaction between the users and the system by providing valuable information for decision-making within educational institutions contributing to the efficient management of student data and other operations.

1.2 Problem Statement

In the current educational system, every institution faces difficulties in managing student information efficiently and effectively. Organizing multiple data for an entire institution such as student enrollment, academic records, financial details, and student personal information can consume a substantial amount of administrative time. The manual data entry process for gathering the data results in data redundancy, errors in academic records, and difficulties in keeping track of information on a real-time basis.

Moreover, some of the existing systems may lack user-friendly interface aspects for students, administration, and academic staff. This might affect the workflow of the student information system in enrolling students, hard-to-access relevant academic information and lack of interaction between the user and the system.

In addition, with the increasing reliance on networks or digital systems, the safety of sensitive student data has become a concern for users. Insufficient security measures may expose vulnerabilities such as data breaches, compromising the privacy and confidentiality of student records.

Furthermore, the lack of a single repository to collect and keep the data about students can result in delays in sharing important information between students, admin, and academic staff. At the same time, important announcements, updates, and notifications may not reach all the users in the supposed time.

1.3 Project Objectives

To provide one stop resources

- Developing a single repository as a student information management system to accommodate all information about the students, academic staff, and administration. It is to view all the data in one place rather than separate places.

To deliver user friendly system

- Designing a user-friendly interface with responsive design to ensure accessibility. It will be easy for all users to get their job done without any errors occurring and can easily navigate through features and functions available in the student information management system.

To develop a system that prioritizes data safety

- Implementing a robust security feature in the Student Information System can ensure the security and privacy of sensitive student information. This helps the system to protect the data from breaches by anonymous users.

To deliver an automated process

- An automatic procedure where the details about the instructors and students such as enrolled subjects, university email address, registration date, subjects that thought by the instructors, enrolled students details and others are retrieved from the administration site which was created or arranged by the admin.

1.4 Project Scope

The project scope of the Student Information System outlines the boundaries of functionalities and features when developing the program for students, admin, and academic staff. Starting the system must have user roles and permissions. It defines different roles such as student, academic staff, and administration. The specific role-based access helps to ensure only the specific user can use the respective page. On the other hand, security measures are important in incorporating security features such as role-based authentication and time out for the section to avoid unauthorized access. Safeguards sensitive data.

Apart from the security function and user roles and permission the features of the system are also equally important for a system. Here starting off with personal information of the user. The user is encouraged to add their details such as name, id, email address, phone number and other private data. Moreover, financial management is another feature in the student information management system. Students as a user can view and settle the tuition fees. Therefore, admin gets to know the financial details of a student.

Besides that, enrollment is an important feature in this system. Because students must enroll into the subjects for a particular time. Admin will manage the course information after the students are done with the enrollment. In terms of attendance students can mark the attendance according to the subject and the time and date will display in real time.

Furthermore, the academic records function can be used by both the students and academic staff. Students can view their final grades from examinations, quizzes, and assignments. Academic staff are responsible for assessing the work done by the students and providing the final marks. Meanwhile the course management is managed by the admin for the academic staff's teaching details. Finally, the academic staff can check the class details.

1.5 Report Organization

Before starting with the chapters this document contains table of contents, declaration, acknowledgement, abstract, references, meeting logs, and checklist for the report. This project is divided into seven separate sections namely, the introduction, literature review, methodology, proposed design, and finally the conclusion. The first chapter discusses the project's problem statement, objectives, scope and how the features work according to the user's permissions in developing the Student Information System.

The second chapter is a literature review that analyzes the existing student information system and summarizes the collected information and details. The methodology is the third chapter that discusses Software Development Life Cycle phases and the suitable method for the project. And talks about how the selected methods work and are carried out throughout the project. Apart from that this chapter also talks about the software and hardware requirements and finally, a Gantt chart is also presented in this chapter.

The fourth chapter is the proposed design. Here in this chapter a sample of system interfaces has been provided. Software representation of flowchart, DFD and UML case diagram has also been discussed here. The representation provides the visualization of how the data flows within the system for each action done by the users. The last chapter is 5 about the work done during Phase 1 whereas Phase 2 is about the plan that needs to be done to provide a final output of the Student Information System as a website.

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

Student Information management systems play a vital role in educational institutions, serving as a singular location for storing, managing, and retrieving student data, including academic records, personal information, financial details, reports, and analytics. The effectiveness of SIMS significantly results in the productivity of administrative processes, the quality of student services, and ultimately, the overall success of educational commitments. In recent years, the student information system has evolved notably, embracing technological advancements, and accustoming to the changing needs of education. This literature review explores the current state of SIMS, highlighting key trends, challenges, and emerging strategies for increasing its effectiveness based on the impact.

2.2 Web-Based Approach

Every student information management system is created based on web-related technologies. Web-based student information systems offer various benefits, including accessibility, flexibility, and scalability. By encouraging web technologies, educational institutions can implement a comprehensive student data management system accessible from anywhere with an internet connection for the intended users. By implementing a web-based approach to create a student information management system, educational institutions can develop a dynamic and adaptable system.

Accessibility

- Easily accessible from anywhere with an internet connection, enabling student data access for different users within the system, such as students, staff, and lecturers.

Security

- Implement solid security measures to protect student information, including encryption and access control.

Enhanced user experience

- Provides a user-friendly interface with intuitive navigation and personalized features.

Availability

- Users can access the data or information in one place whenever they want.

2.3 Existing Student Information Management System

Before developing the system, I researched other existing systems. Conducting a study on another system provides numerous benefits, especially when considering adding any features that are not available in the original system or enhancing those errored features. Analyzing an existing system is an opportunity to identify the weaknesses and strengths of the functions that work. In terms of user feedback, the study can provide the user's thoughts based on satisfaction with using it. User feedback is important to understand the needs and requirements which can help to enhance the developing websites or applications. In conclusion, studying an existing system is a necessary step in the process of designing, developing, maintaining, and upgrading a system. This ensures providing user-friendly products with error-free websites and applications.

Figure 2.3.1: PowerSchool

From the figure 2.3.1 the PowerSchool was created in North America, and it is a cloud-based software for K-12 education. This system acts as a bridge between students, teachers, parents, and the administration of an institution. The services of this system are delivered through Microsoft Azure. According to PowerSchool (2023), PowerSchool became a public company on July 28, 2021. Even though it is a public company, it offers a service for both K-12 private and public schools and districts. PowerSchool Student Information Cloud's purpose is to provide student information, enrollment management, and database management. This system maintains accurate and complete student data by ensuring the information is easily accessible and delivering precise details. Apart from the features, this system takes the secrecy and privacy of data importantly. Based on PowerSchool, Security (2023) they are using security operations center type 2 (SOC 2) to maintain the confidentiality, integrity, and availability of the students' information (CIA) which runs 24x7x365. To avoid any vulnerabilities threatening the system PowerSchool will do penetration testing. In PowerSchool, the administrators use a Lightweight Directory Access Protocol (LDAP) to securely manage password authentication for teachers, students, and parents. In terms of system security, the users can only access the site according to the time set, the system is automatically inactive after several minutes. The PowerSchool enables session cookies to span subdomains. This system security works for every user.

Figure 2.3.2: Blackbaud

Based on the figure 2.3.2, and according to Blackbaud (2023), this cloud-based software is designed for fundraising, nonprofit financial management, education, corporate social responsibility (CSR), and more. Among its offerings, Blackbaud provides Education Solutions for K-12 private and parochial schools, as well as higher education institutions. The services include enrollment management systems, learning management systems, and student information systems, which facilitate seamless data flow and a user-friendly experience for parents, students, faculty, and staff via single login and mobile access. Given its cloud-based nature, security is a primary concern in managing organizational data. The system upholds the CIA (Confidentiality, Integrity, Availability) information security standard and employs industry control frameworks like NIST CSF to mitigate cybersecurity risks. To safeguard customer data, Blackbaud utilizes SOC 1 Type 2 reports, which assess design and operational effectiveness. Furthermore, as stated by Blackbaud, Security (2023), they implement encryption mechanisms such as TLS 1.2, AES 256, RSA 1024, and other FIPS 140-2 compliant algorithms.

Figure 2.3.3: Skyward

Based on the figure 2.3.3, according to Skyward (2023), Skyward has been serving K-12 education for over 40 years, offering software solutions for student management. Key features of Skyward include office and administration tools, classroom tools, family engagement, and student services. Office and administration features include scheduling, fee management, and curriculum management. Classroom tools encompass attendance tracking, behavior tracking, and a grade book. For family engagement, Skyward provides family access and a family mobile app. Student services include health services, college and career readiness, and behavior management. Any changes made in the scheduling site are updated in real-time. Parents can view a student's fee structure through pre-built reports in the system. According to Skyward's Privacy Policy (2023), the system employs role-based access control (RBAC) to ensure users access only features and data relevant to their roles, such as students and staff, thereby limiting unauthorized access to sensitive information. Skyward uses SSL (HTTPS) via Transport Layer Security (TLS) to encrypt communications, formerly known as Secure Socket Layer (SSL). Kerberos is implemented for authentication and authorization, providing a secure option. Additionally, dual-factor biometric credentials are used for data center access, with all entrances either alarmed or monitored, often utilizing RFID badges or biometric scanners. Based on Skyward (2023), the system restricts direct database access, allowing it only through VPN connections to cloud-hosting data centers. VPN connections are limited to authorized district system admin personnel to prevent unauthorized access.

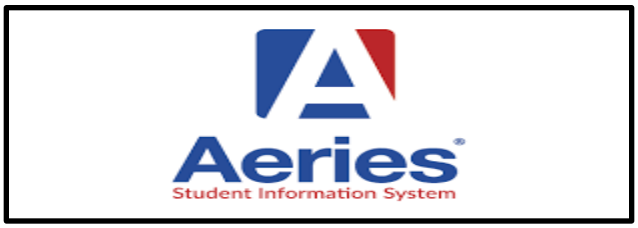


Figure 2.3.4: Aeries

Based on the figure 2.3.4 as stated by Aeries Software (2023), Aeries is a student information system with over 40 years of experience serving K-12 districts in California and Texas. The features offered include student information systems, enrollment, and mobile apps. The student information system supports solutions for student data, scheduling, and grade reporting. The enrollment feature supports multiple languages, allowing different language speakers to continue from where they left off with seamless integration and timesaving features. The mobile app, developed for students, teachers, and parents, provides access to information anytime and anywhere. Aeries integrates with partners like Microsoft, Google Classroom, Canvas, and Illuminate to enhance system functionality. According to Aeries Software, Cloud Hosted Services (2023), Aeries is built on Amazon Web Services, leveraging the platform's scalability, security, and reliability. Aeries Cloud Hosted Services provides a fully managed end-to-end platform with automatic scaling based on district size, ensuring faster performance. Data and information collected are monitored and accessed only by authorized personnel. In addition to being a web-based system, Aeries is also available on mobile devices.

Figure 2.3.5: Rediker

Based on the figure 2.3.5 Rediker Software, they have been providing technology solutions to public, private, and international schools in over 120 countries for more than 44 years. Their services include gradebook, fund accounting, mobile apps for iOS and Android, report writing, notifications, attendance tracking, transcripts, ParentPlus and StudentPlus portals, discipline management, and e-portfolios. For attendance, Rediker integrates with the AdminPlus Mobile App to monitor both student and staff attendance. They also offer PlusPortals, a family portal that enables teachers to communicate and share information with parents and students simultaneously. The system supports online learning through dedicated websites for students. As mentioned by Rediker in their Integrations and Partnerships documentation, they collaborate with leading educational organizations such as FACTS, Frontline Education, and Google Classroom, and have partnered with Microsoft Azure Cloud to ensure seamless connections between web and mobile applications. According to Rediker's Privacy Policy, they automatically collect and log information such as IP addresses, accessed pages, features used on the website, and geographical locations when users visit the site. They also use analytics and advertising cookies. To protect data, Rediker configures firewalls for real-time scanning of incoming and outgoing traffic and employs IPS/IDS (Intrusion Prevention System/Intrusion Detection System) to inspect traffic and block threats. HTTPS (Hypertext Transfer Protocol Secure) ensures authentication and strong encryption while using the website.

Figure 2.3.6: Teachmint

Based on the figure 2.3.6 Teachmint, a multinational company, has developed the Integrated School Platform (ISP), serving over 15 million users across many countries and available in 20+ languages, as stated by Teachmint (2023). This cloud-based system uses SaaS as its cloud delivery platform and offers various solutions, including learning management systems, fee management, student information systems, admission management, and exam planners. The student information system features include student profiles, directories, personal information, academic performance, and attendance details. This system consolidates all student data into a single interface via the SaaS cloud, facilitating easy monitoring of academic progress. Additionally, it helps administrators manage outstanding fees and access information about the facilities used by a student, all within a unified system. Unlike other systems, this one does not provide a separate portal for parents; instead, access to specific fields is determined by the administrators, as mentioned by Teachmint (2023). To become a user, a one-time password (OTP) is sent to a valid mobile number. Teachmint employs several security measures, including a Web Application Firewall (WAF), cloud protection, routine audits, data encryption, and Role-Based Access Control (RBAC). The WAF monitors and controls incoming web traffic, such as DOS attacks, and blocks malicious requests. Additionally, Dynamic Application Security Testing (DAST) is implemented to identify and address vulnerabilities or weaknesses that attackers could exploit to threaten the system.

Figure 2.3.7: QuickSchools

Based on the figure 2.3.7 QuickSchools provides a comprehensive school management system with features that include managing student and teacher information, attendance, gradebook, transcripts, parent access, report cards, homework, school scheduling, and admissions. This system allows parents to log in and monitor their child's progress by tracking homework, attendance, exam records, and fee management. Beyond student information management, QuickSchools also offers teacher management features that assist teachers with class scheduling, creating new classes, and preparing reports on student achievements and progress. When teachers submit reports, the system automatically notifies students and parents. According to Azroy Kandan (2015), QuickSchools is hosted by Amazon Web Services (AWS) in Virginia and uses standard encryption protocols like SSL, ensuring that all passwords are encrypted, even QuickSchools cannot access them. As mentioned by Azroy Kandan (2022), QuickSchools employs 2-factor Authentication (2FA) via Google Authentication. The system collects automated information such as the IP address of the device used to log in, regional location, browser type, and operating system. Using cookies, the system serves advertisements on websites that may interest users based on their use of the QuickSchools website. Additionally, it supports Do Not Track (DNT) settings in users' web browsers to prevent the collection of information about the websites they visit.

Figure 2.3.8: Wisenet

From the figure 2.3.8 and according to Wisenet, an Australian software solution founded in 1997, it operates as a cloud-based Learning Relationship Management platform and serves a multinational client base. Colleges and educational institutions utilize Wisenet as a student management system to engage and inform students, manage administrative tasks such as CRM for education, and support online learning through Wisenet One. Key features of the student management system include timetables, enrollment, document management, and reporting. Their network security involves using firewalls with rule sets, Access Control Lists (ACLs), and configurations to restrict information transfer to specific system services. Wisenet applications are accessed via HTTPS, utilizing Secure Socket Layer (SSL) to protect against man-in-the-middle attacks, tampering, and message forgery. As stated by Wisenet (2023), their Application Programming Interface (API) links applications through an interface containing several Wisenet fields called 'endpoints.' HTTPS Basic Authentication (RFC 2617) via SSL is used to convey the user's identity by providing a valid username and password. Wisenet also employs Two-Factor Authentication (2FA) to prevent unauthorized access, Single Sign-On (SSO) for multiple system access with a single set of credentials, and Role-Based Access Control (RBAC) to assign permissions based on user roles specified during registration. To store and manage user data, Wisenet utilizes AWS cloud services, keeping all data in a single repository.

Figure 2.3.9: Gradelink

From the figure 2.3.9 the Gradelink is a cloud-based student information system designed for easy navigation through its resources. It provides fully integrated tools to manage administrative tasks for educational institutions. Gradelink helps track various data such as student information, employee information, class schedules, attendance, grade books, medical records, and more. Its student information management system monitors student enrollment status stores multiple contacts and emergency addresses, and allows data to be exported into Excel sheets. As stated by Gradelink (2023), all web and mobile connections are secured with SSL encryption to protect web traffic on the server. The collected data is archived and delivered as an encrypted SQL server backup file. Gradelink maintains a locked and secure data center repository in Irvine, California, accessible only to a limited number of authorized IT staff through remote server tools that are regularly logged and audited. In addition to the data center, Gradelink employs network protection protocols such as network segregation to separate high-risk elements from lower-risk networks, firewalls, router technologies, an intrusion detection system using log data, alert mechanisms, and secure VPN connectivity for all authorized personnel, as mentioned in Gradelink Security Overview (2023). These measures help prevent and mitigate the impact of malicious traffic and threats, ensuring the system's security. Gradelink also integrates seamlessly with Google Classroom, ClassLink, and Apple School Manager.

Figure 2.3.10: Orah

From the figure 2.3.10 the Orah, previously known as Boardingware until July 1st, 2021, as mentioned by Paul Organ (2021), has been designed to integrate with existing student information systems since 2014. According to Boardingware (2023), the company has served over 300 schools, 70,000+ students across 20 countries, and has been operational for over nine years. Orah offers features such as attendance tracking, coordination of student activities and schedules, student health monitoring, mood checks, and data safeguarding. Students and parents or guardians can view and sign up for these events via the mobile app or website. As detailed in the Boardingware Cloud Security Whitepaper (2023), Orah utilizes AWS as its cloud platform. As a SaaS provider, Boardingware handles cloud configurations, including user data, hosted information, firewall setups, and network traffic protection. In Orah, usernames and passwords are encrypted with an 11-factor cryptographic hash function. Authentication is server-side, returning a token over an SSL connection. These tokens, encrypted with 256-bit entropy and signed with an RSA signature, ensure that user credentials must be authenticated with each system access. Orah employs Amazon Virtual Private Cloud (Amazon VPC) with multiple security restrictions, assigning private (RFC 1918) IP addresses within the VPC to create an isolated network separated from other Amazon VPCs.

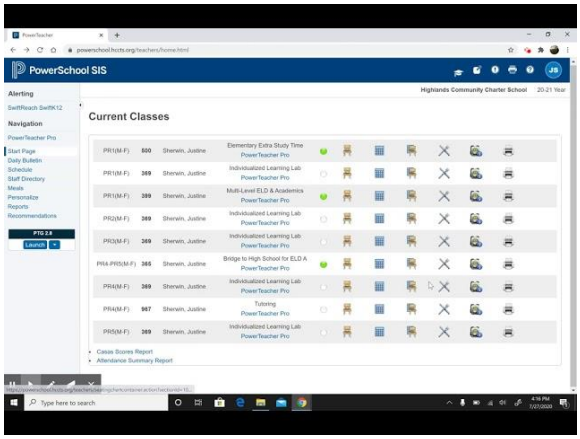
Table 2.3.11: Summary of existing system

Student Management System	Functions	Security Features
PowerSchool	Student Information Cloud Personalized Learning Cloud Educator Effectiveness Cloud	Service Organization Cont4rol 2 Lightweight Directory Access Control (LDAP) Time-Based Access Control
Blackbaud	Enrollment Management System Learning Management System Student Information System	Encryption Mechanism (TLS, RSA) Microsoft Azure Active Directory Security Assertion Markup Language
Skyward	Office and Administration Classroom Tools Family Engagement Student Services	Role-Based Access Control HTTPS RFID VPN
Aeries	Student Information System Enrollment Mobile Apps	Hashing System MD5, SHA1 Duo 2-Factor Authentication Google Authentication
Rediker	School-to-Home Communication Mobile Access Real-Time Reporting Online Learning	Intrusion Prevention System HTTPS Google Analytics
Teachmint	Learning Management System	One Time Password Web Application Firewall

	Fee Management Student Information System	Role-Based Access Control Dynamic Application Security Testing
QuickSchools	School Schedule Exam Record Fee Management Gradebook	Secure Socket Layer Encryption 2 Factor Authentication Cookies Do Not Track Setting
Wisenet	CRM for Education Student Management System Online Learning Platform	Access Control List 2 Factor Authentication Single Sign On Role-Based Access Control
Gradelink	Class Schedule Student Information Attendance Management	SSL SQL Server Backup VPN Network Segregation
Orah	Attendance Management Student Health Management Student Mood Check	SSL RSA Amazon Virtual Private Cloud TLS

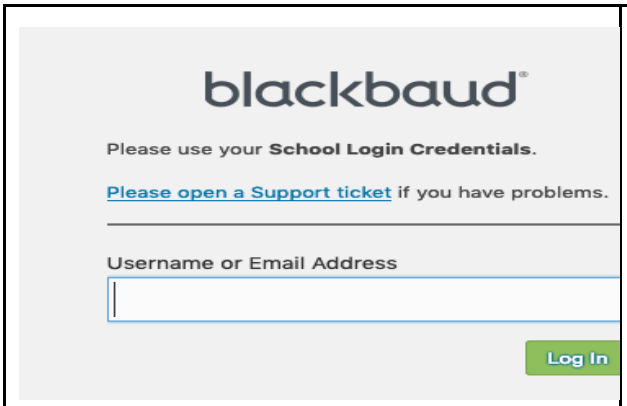
2.4 Example of Existing System Interface

Student and Parent Sign in Page

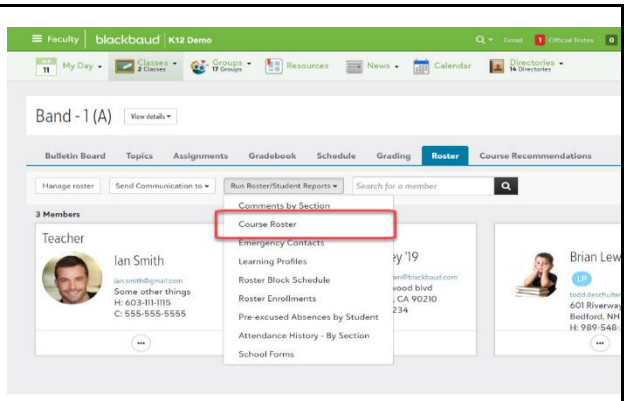


Current Classes for Teacher Page

Figure 2.4.1: PowerSchool

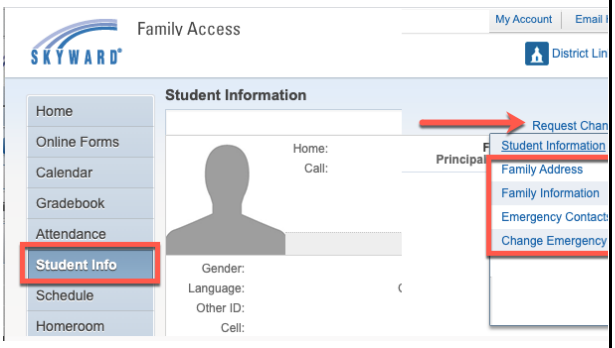


Login Page

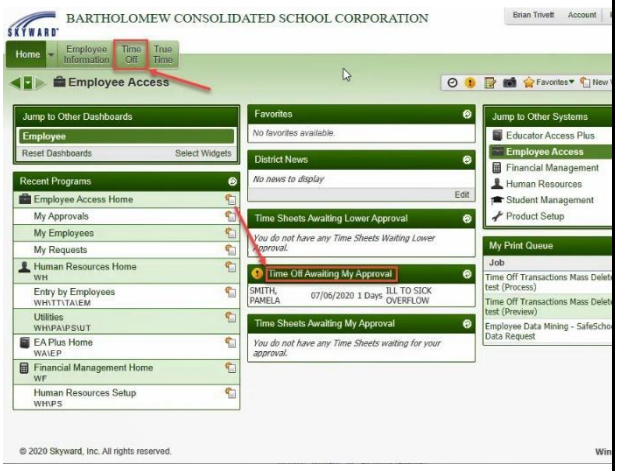


Teacher Portal Page

Figure 2.4.2: Blackbaud

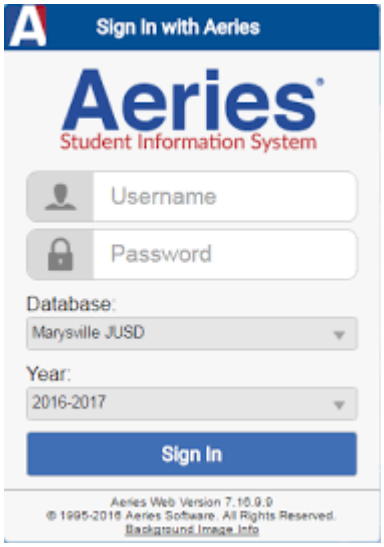


Family Access Page

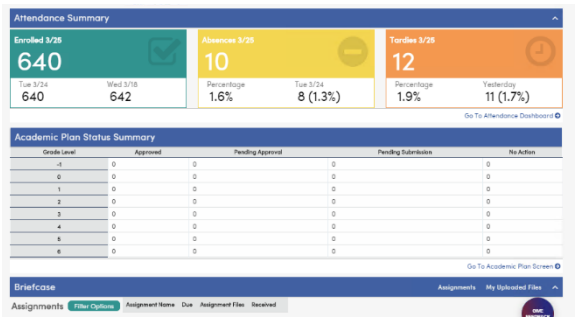


Employee Access Page

Figure 2.4.3: Skyward

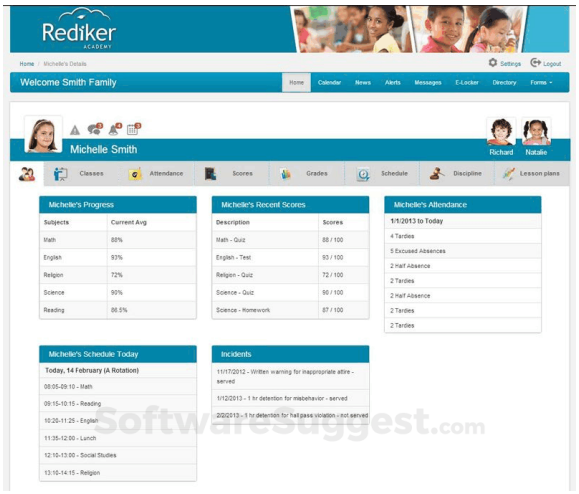


Login Page

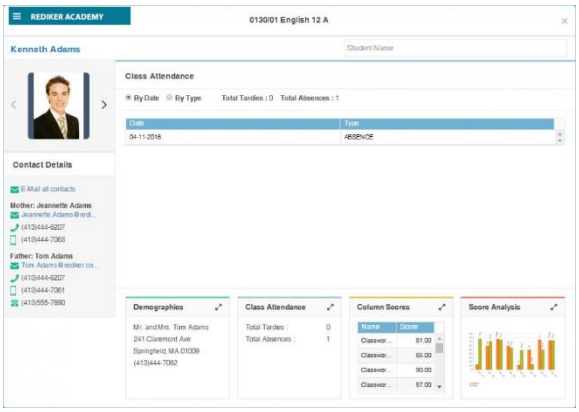


Teacher Portal for Attendance Summary

Figure 2.4.4: Aeries

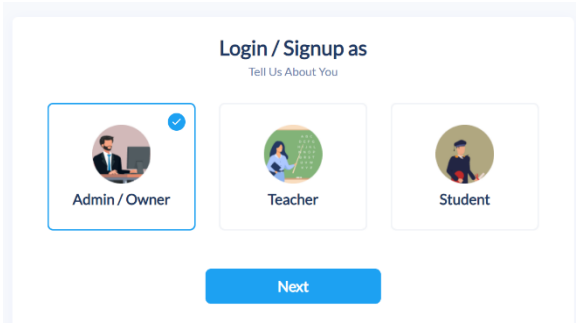


Student Information Page



TeacherPlus Web Gradebook

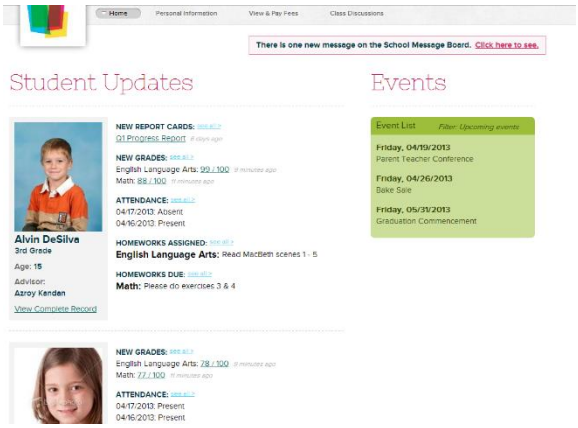
Figure 2.4.5: Rediker



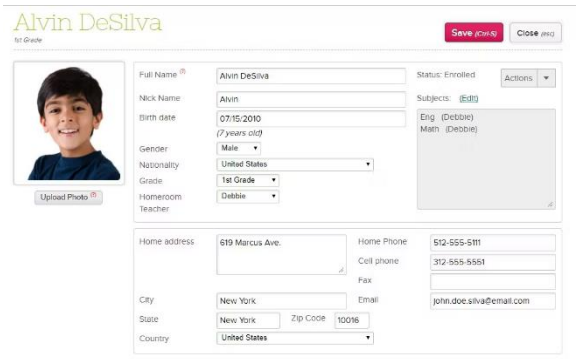
Login or Sign in Page

Fee Management Option Page

Figure 2.4.6: Teachmint

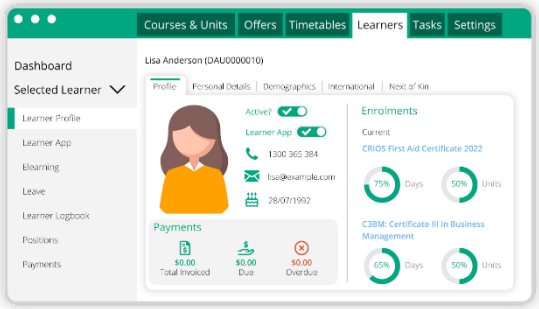


Student Update Page

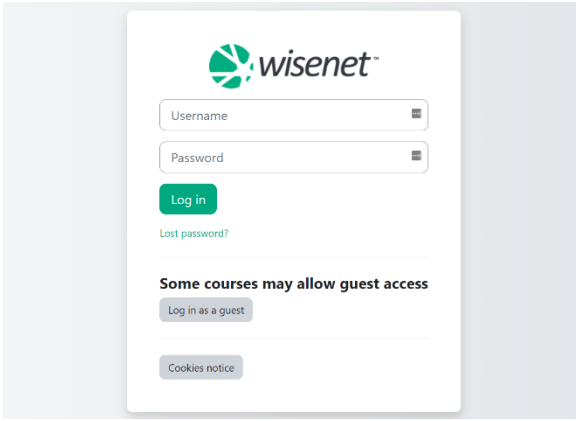


Student Information Page

Figure 2.4.7: QuickSchools

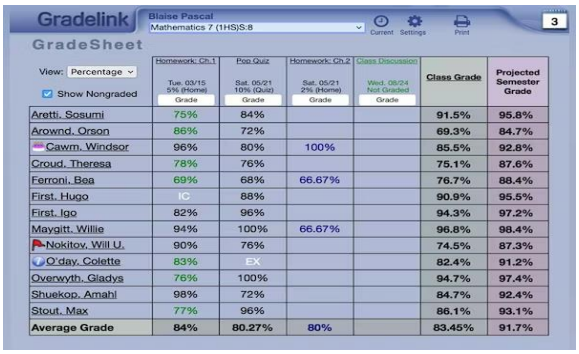


Student Enrollment Page

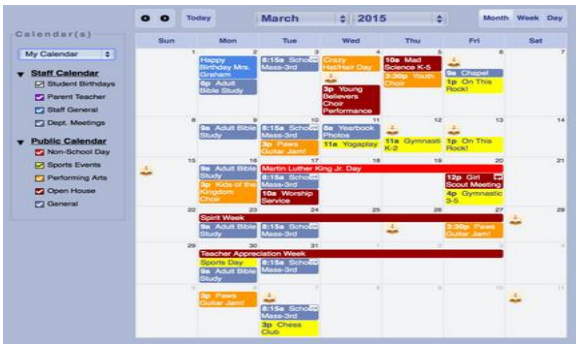


Login and Sign in Page

Figure 2.4.8: Wisenet

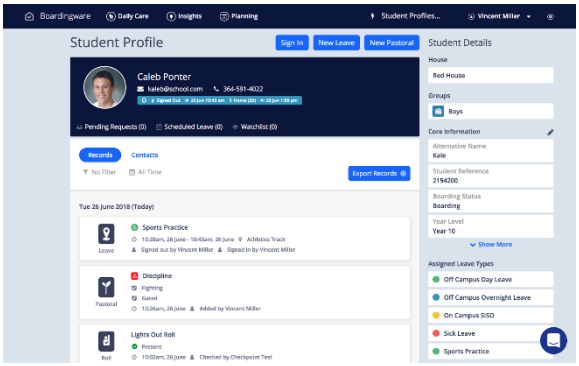


Gradesheet Page

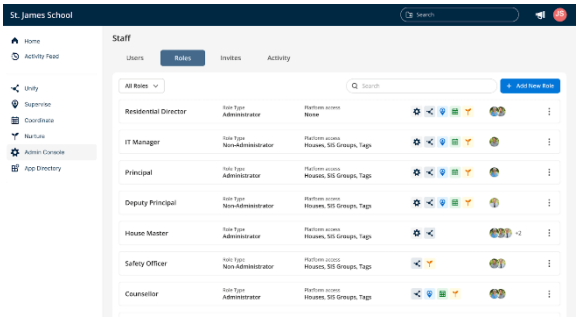


Academic Calendar Page

Figure 2.4.9: Gradelink



Student Profile Page



Staff Page

Figure 2.4.10: Orah

2.5 Summary

In summary, Chapter 2 introduces Student Information System Management and talks about the existing system. This system is a single repository to store all information related to students, such as education and finances. From the study of existing systems, I collected data about the software's functions and security features. For example, enrollment, exam records, role-based access, and HTTPS in terms of service and data protection respectively. Moreover, in Chapter 2, I have also attached some system interface examples. From this chapter we can know about the features and functions used by the existing system in a different way.

CHAPTER 3

METHODOLOGY

3.1 Overview

It is an important task to complete any research or project at each time. Software Development Life Cycle is a methodology useful to design and develop high-quality software after identifying cost-effectiveness and time efficiency. SDLC is used to improve software quality and allocate resources to complete projects. Caring out robust testing procedures after developing an application will help to produce products with high performance and speed while being user-friendly and error-free. Distributing resources which includes money, assets, and people can give the development team the necessary support to achieve their project goals. Waterfall, spiral, agile, road, incremental and v-model are software development methodologies. Using suitable methodologies depends on the size or complexity of a project, the requirements of shareholders, available resources or budgets and the development team's skills. (LinkedIn, 2023). The discussion below will be based on suitable methodologies for applying for the Student Information Management System.

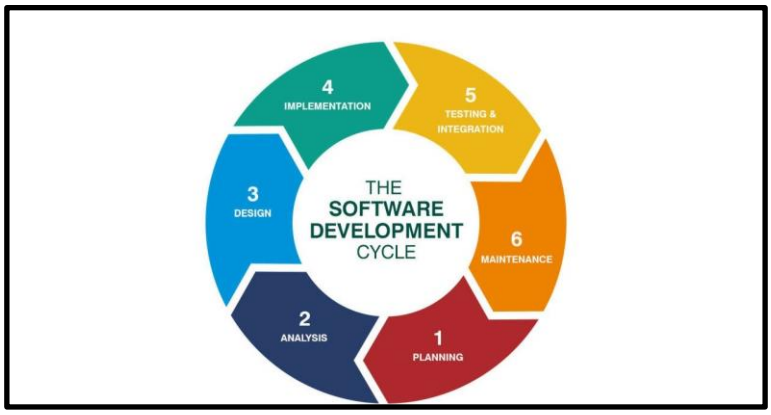


Figure 3.1.1: Process of SDLC

Based on Figure 3.1.1 and according to Jilvan Pinheiro, (2018, April 12). Software Development Life Cycle shows the process of iterative development. Planning is the initial phase to identify the project's objectives, goals, and requirements of the stakeholders. Next is analyzing the gathered information from the planning phase. The design phase is to construct the wanted software according to the stakeholders' requirements with available resources. After designing the software, the implementation part comes in to start coding for the developers. The testing part is conducted to examine the developed product and whether it satisfies the goals or objectives of the system without any faults or errors. The deployment phase happens when the system is successfully developed and distributed to the aimed users to check for bugs in the system as a beta version. The last phase is the maintenance, once the software is fully released to the users the developing team must update or upgrade from time to time to encounter any problems that arise.

3.2 Chosen Methodology

For developing the Student Information System, I have chosen the waterfall methodology. The waterfall is a model where the following steps are dependent on the previously completed steps. This ensures that the requirements and functions are identified and completed. The waterfall method is known for being well-documented, enabling stakeholders to have a clear view and understanding of the functions of a project and it can be assured to meet the expectations or goals of the project. Using a waterfall in developing a Student Information System will be useful in beforehand planning and the sequential implementations with managing the budget and time. Below the figure 3.2.1 shows the flow of waterfall methodology.

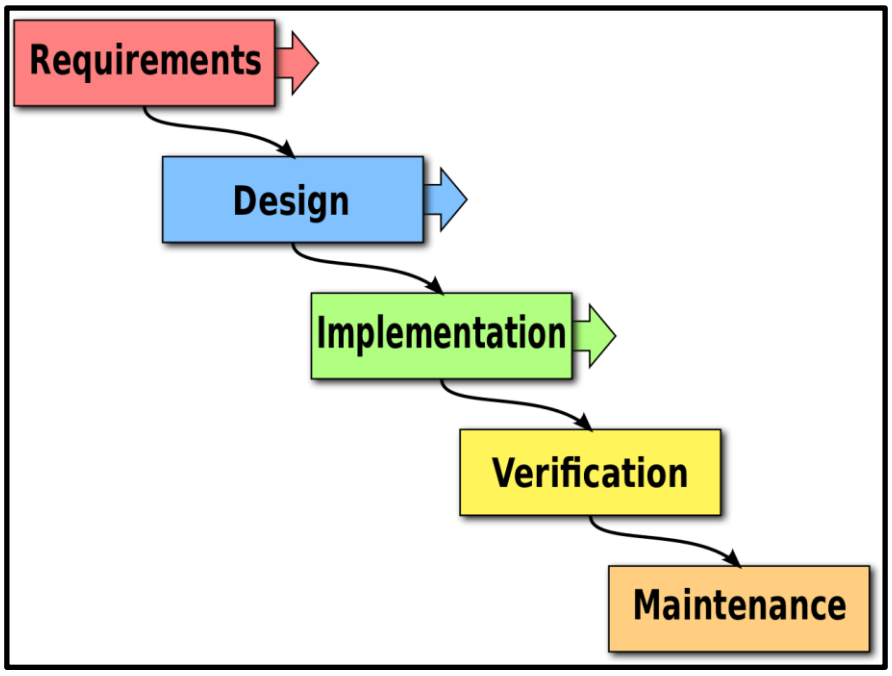


Figure 3.2.1: Waterfall Methodology

3.3 How Does the Waterfall Model Work

Phase 1: Planning

Phase 1 of the waterfall model is conducted to collect and document the information of the developing system in this case Student Information System. Establishing the objectives, problem statement and goal of the project are based on gathered information. Therefore phase 1 is important for the developers to pay attention to proceeding with the assignment.

Phase 2: Analysis

This phase is important to understand a system's requirements. Based on Harshuhi. (2020). What is the Waterfall Methodology or Model in SDLC? In the analysis phase the team will create flow charts, and UML diagrams and will document them to present and review the project with the stakeholders.

Phase 3: Design

In phase 3 once the flow charts and UML diagrams are explained and accepted by the stakeholders the system development is started. A report should be drawn out to explain clearly and easily to use guidelines while creating the model. The creators should be able to think like users in what they expect while using the software to come up with a user-friendly application. At this level, developers are required to create system interfaces such as a sign-in page, login page, and other features according to the system requirements. While designing the interfaces a system flow also should be created which represents the interaction between the users and the system.

Phase 4: Implementation

Implementation is an important process of SDLC, therefore every step in this phase should be taken effectively to obtain the desired final output as a perfect Student Information System. The first step is writing code according to the designs and requirements using any code editor such as VS Code, Notepad++ and so on. While writing the code, algorithms, databases, and security features should be done simultaneously. Databases are written to store data collected from the Student Information System in one place to use it from one place. Security features must be created in any system to protect the information privacy of the users.

Phase 5: Testing

At the end, before deploying the final product, the system should be tested. This testing consists of detailed procedures on how and who will perform the processes, for example pen testing. Compilation of system testing with success and well-architecture Student Information System ready to deploy into the real world for the users with the awareness of stakeholders.

Table 3.3.1: Advantages and disadvantages of Waterfall Methodology

Advantage	Disadvantage
• Simple and easy to use. The details are documented straightforwardly after each task completion	• Long time. Since the project's phase is created after a task is completed it takes more time to complete the entire report for a large system.
• Well-defined phase The documents are divided into discrete phases such as requirement, planning, design, implementing and testing the system.	• It's not easy to make changes. Once a phase is done it will be hard to make changes if needed without affecting the entire project's progress

3.4 Requirements

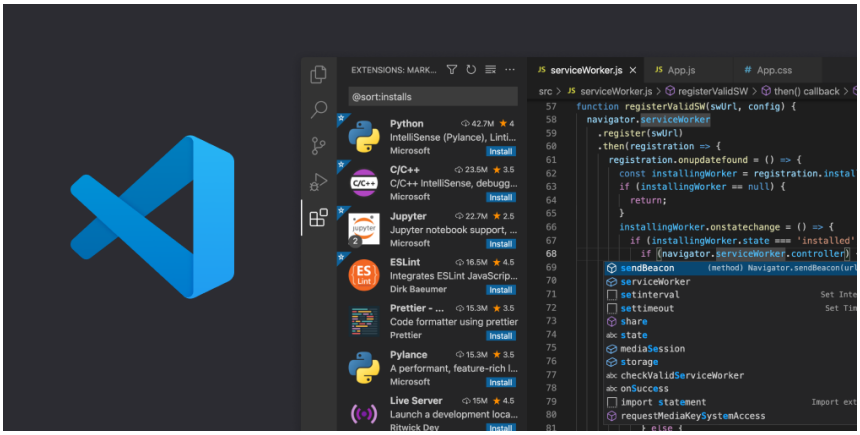


Figure 3.4.1: Visual Studio Code

The above figure 3.4.1 shows the Visual Studio Code, commonly known as VS code is a source-code editor. This is an open source provided by Microsoft to Windows 10 onwards, OS X 10.11 or later and Linux. This software supports multiple programming languages such as Python, HTML, Java, C++ and many more. VS code provides many features like debugging, auto-indentation, bracket matching, syntax highlighting, etc. Users can install the source from the official website independently. The latest version of this software is 1.85 which was released in November 2023. Download the VS Code installer for Windows. Once it is completed, run the installer by default and it is saved under C:\Users\Username\AppData\Local\Programs.

Figure 3.4.2: Python

Figure 3.4.2 shows a type of programming languages that have been used in creating Secured Student Information Management Systems such as Python, HTML, CSS and Java Script. Python is the backend language where the whole has been built upon using it whereas HTML, CSS and Java Script is for the frontend language where it is responsible for the layout or interface creation. Django is a Python high-level open-source web framework. The reason for using Django is the built-in functions such Django Admin, securely automatic hashing, checking password, provides cross-site request forgery protection and provides the support for enabling HTTPS. This high-level framework makes the system more secure. The reason for using frontend language is to create a user-friendly, easy to navigate together to develop structure, designs, and functionality of web server.

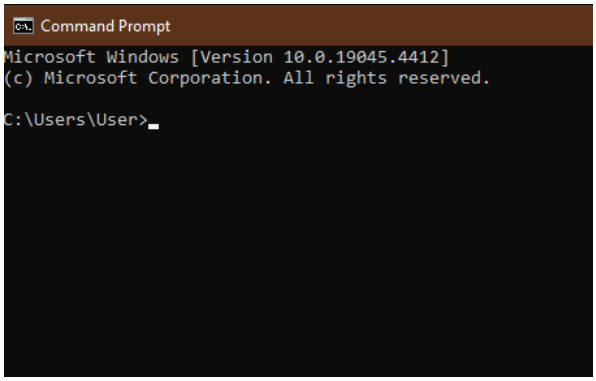
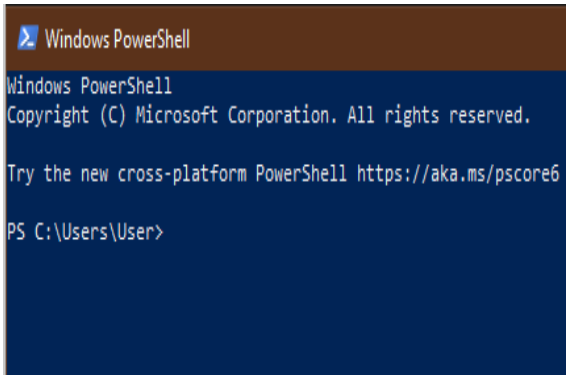
CMD	Windows PowerShell
	

Figure 3.4.3: Command prompt

The above figure 3.4.3 shows the interface of two different command prompts. The command prompt (CMD) is a command-line interface to interact with the operating system and it does basic tasks in a simple and faster way but lacks in advanced functionality. CMD uses simple batch scripting, in tasks such as file manipulation, and simple system commands. Whereas in Windows PowerShell is a task automation and configuration management framework consisting of a command-line shell and an associated scripting language developed by Microsoft, for system administration and automation. PowerShell offers more advanced scripting access to .NET Framework, strong integration with Active Directory Exchange, Windows System and Azure. I used the Windows PowerShell for generating SSL certificates to move from HTTP to HTTPS.

Figure 3.4.4: Device

The figure 3.4.4 shows the device that I will used; Lenovo IdeaPad with Windows 10 pro version 22H2. This edition was installed on 19/9/2022. This device holds 8.00 GB of Random Access Memory (RAM). Lenovo IdeaPad works on the x64-based processor. Solid state drives are faster than hard disk drives when accessing a large amount of storage in the device. To connect every system to the network NIC a network interface card is needed in a device. Last, hardware requirements for a system depend on the specific tasks and applications planned to use.

3.5 Gantt Chart

Table 3.5.1: Gantt Chart for FYP1

Activities/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
FYP Meeting														
Title finding and Confirming														
Chapter 2 - Literature Review														
Chapter 3 - Methodology														
Chapter 4 - Proposed Design														
Chapter 1 - Introduction														
Chapter 5 - Conclusion														
Finalizing Report														
Preparing for Presentation														
Presentation														

Table 3.5.2: Gantt Chart for FYP2

Activities/Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Setting up the project														
Coding														
Testing and Evaluating														
Finalizing Report														
Preparing for Presentation														
Presentation														

As we talked about the planning methodology a Gantt chart is important to estimate how long the project takes to complete. This Gantt chart visualizes the time taken to complete each task. It was a 14-week duration. The rows of this Gantt chart show the tasks and the columns represent the week needed to complete the activities to be carried out in the first phase of the final year project. The bar between the row and columns is the duration taken to finish a task. This chart helps us to understand the progress of the project and be able to finish it in the given time.

There are two Gantt chart figures one is FYP1 and FYP2. The timeline for FYP1 starts with confirming a title. After the title is being finalized, Secured Student Information Management System, the literature review is made based on the existing system. Then, evaluating which methodology is suitable for carrying out the project from the day one. For this project Waterfall Methodology have been chosen. Proposing a design on how does the system looks like or functions before developing it and considering all the important requirements for developing the system such as VS code, CMD, hardware requirements and others. Most importantly determining which type of programming language are going to be used in this case, I chose Python programming language, this is because, this language is easy to learn and use which is useful for creating web servers. The next two chapters are Introduction and the Conclusion. Introduction is

the part where project scope, project objectives, and problem statement. This chapter aims to identify the challenges by developing a secured student information system with user-friendly interface. And by identifying the challenges need to find out the project objectives and scope to further improve the system against the challenges. Last chapter is the conclusion. In here we conclude everything have done, researched, and implemented ideas in terms of developing efficient and effective Secured Student Information Management System.

The Gantt chart for FYP2 shows the timeline for developing the system fully or partially based on the FYP1. First thing first starting with setting up the project like creating a directory in the device path. After starting the project, we need to perform coding to make all the ideas into functions and resources so that the Secured Student Information Management System is ready to test and evaluate the flow of the system. Once everything settled with the coding and not identifying errors or bugs during the testing then finally, writing a report to finalize every task done during the FYP2. Finally, prepare for the presentation in week 14.

3.6 Summary

In Chapter 3 we have walked through the SDLC methodologies suitable for developing a Student Information System. The chosen method is waterfall. Identifying a suitable methodology initially helps further the project without difficulties. We have also talked about requirements such as hardware in terms of devices, and software such as testing, and programming language. It is important to know about the requirements for smooth execution of the project and optimal user experience. Finally, the Gantt chart was presented in this chapter to understand the timeline and manage the tasks according to the time of completing phase 1 of FYP in creating a Student Information System.

CHAPTER 4

IMPLEMENTATION

4.1 Overview

The proposed design is a description done on the computer. Developing a well-performing system methodology is important, as discussed earlier in Chapter 3. Designing the program interfaces is important and needs to be done carefully while considering the requirements, objectives, and user expectations. Creating user-friendly software is easy for the users to use. A data flow diagram (DFD) must be constructed apart from interfaces. DFD is a design that explains or can visualize how the data flows through a system based on certain processes or procedures taken inside the program. Next is the unified modeling language UML case diagram to visualize the actors of the system and the actions. DFD focuses on illustrating how data moves and transforms between system operations while flow charts show the actions or decisions made by the users. Next is the UML Case Diagram, which identifies user interactions between users and the system.

4.2 Data Flow Diagram, Flow Chart, and UML

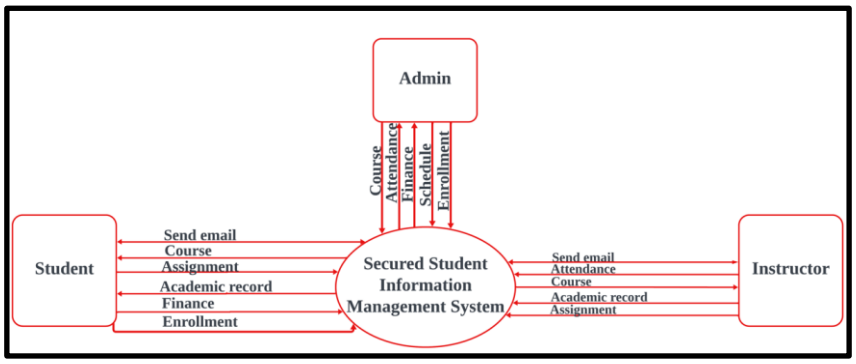


Figure 4.2.1: DFD - Level 0

Figure 4.2.1 represents a "Secured Student Information Management System" and illustrates the interactions between different types of users as in (Admin, Student and Instructor) and the system.

Students interact with the system in various ways: they can send and receive emails via the system, access course information, view and manage assignments, and check their academic records to see the grades for the subjects they are registered in. Additionally, students can view and pay their fees through the finance section and enroll in available courses through the enrollment feature.

Instructors interact with the system by sending and receiving emails, recording and referring to student attendance records, and viewing course information. They can manage academic records by adding, updating, and deleting student grades. Additionally, instructors can create assignments and view both the assignments and their submissions by students.

Admins interact with the system by adding, updating, and editing course information and schedules for subjects. They can also view attendance records, enroll students from the admin site, and view the payment history for students.

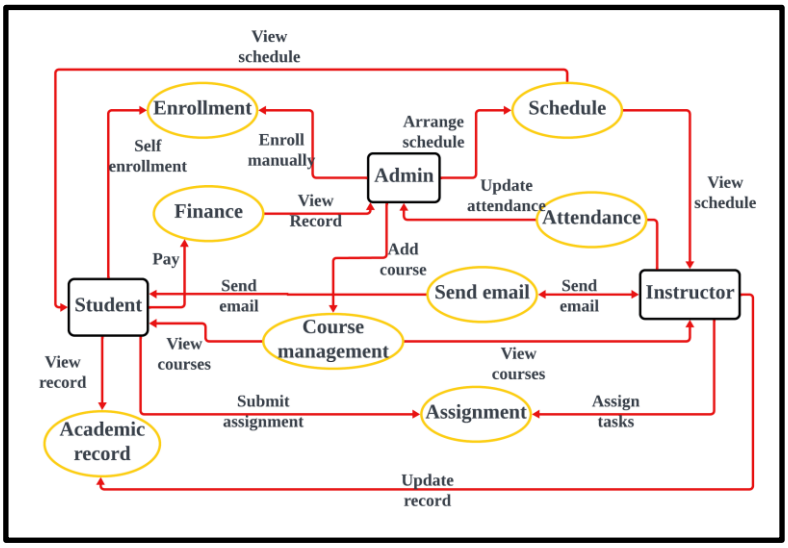


Figure 4.2.2: DFD level 1

Figure 4.2.2 shows the DFD level 1 of enhanced version of level 0 which explains external entities, giving a clear view of the entire system for the stakeholders.

The interaction between Admin and Students involves the admin managing students' enrollments, schedules, attendance, and course management, all of which are accessible to students. Additionally, the Admin can view emails sent by students. Regarding the interaction between Admin and Instructors, the Admin arranges schedules, enrolls students, manages courses, and views attendance records, and can also view emails sent by instructors.

Communication between Instructors and Students includes the ability for both parties to send emails, with students submitting assignments and instructors creating them. Instructors can

also add, update, and delete grades. Student self-services allow students to manage enrollments, pay fees, view courses, submit assignments, and view their academic records. Instructors are responsible for updating attendance, assigning tasks, and viewing the courses they teach.

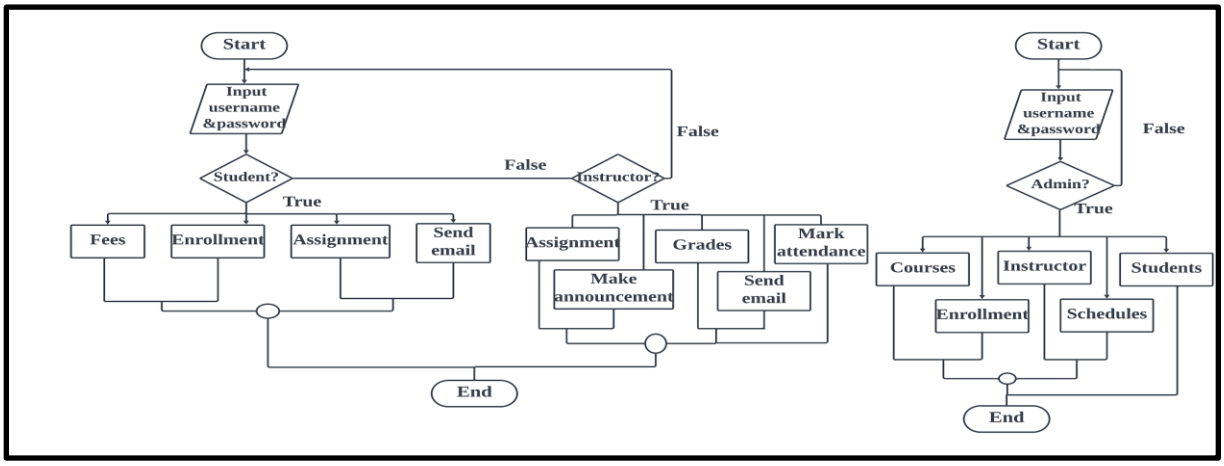


Figure 4.2.3: Flowchart for the entire system

The figure 4.2.3 shows the flowchart for Secured Student Information Management System. Upon starting instructors and students are required to input their credentials such as password and username. The system first checks the database if the username and password are matching to begin the authentication process. During the register section the users (instructor or students) are required to enter the university address provided to them by the admin and together with username and password to save it to the database. The registration will be successful only if the university email is saved in the admin database if not the registration will be unsuccessful. Using the entered username and password during the registration the system will grant the authorization for the users. The system passes the grant based on the keyword (stu and acad) in the email; for students (@stu.uni.edu), for instructors (@acad.uni.edu). So based on the keyword the student will bring to the student dashboard and instructor to the instructor dashboard. Once entered the system the users can perform the actions that are available in the dashboards. If the system fails to grant the access, then the users have to check the entered password and username or it means that the user is certified to use the system.

As for the admin they are recognized as a super user. Admin does have their own URL address. If the username and password are correct, then the admin gets the permission to use the system. Admins, upon successful authentication, can manage courses, oversee student enrollments, handle instructor details, manage class schedules and student records and instructor records.

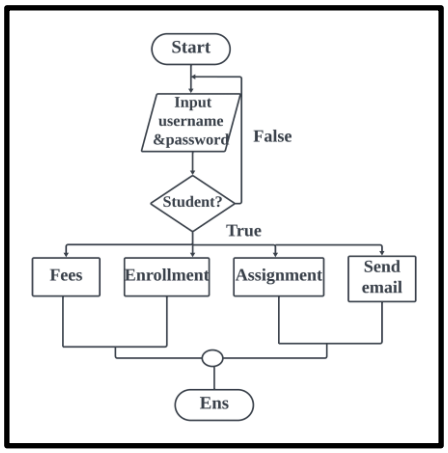


Figure 4.2.4: Flowchart for Students

The figure 4.2.4shows a flowchart is for students. If the system recognizes the username and password entered as a student then they are allowed to make actions to pay fees according to the number of subjects and the amount for the subjects, enroll into subjects that are available, submit assignments, and send email to the instructors.

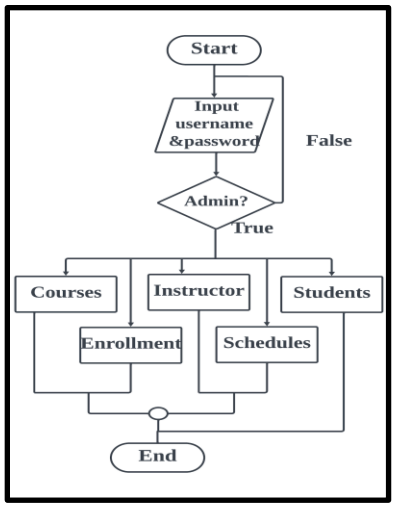


Figure 4.2.5: Flowchart for admin

The flowchart figure 4.2.5 is for the admin to manage the students and instructors' records. The admin can adjust the class schedule, add course details such as code, name, and fees. Admin can also add or delete and edit the students and instructor details if the students changed the major after some time and generates new student emails with new majors and random words or numbers. As for instructors, the admin can change the subject they have to teach in the future. Enrollment from the admin can be done for the students.

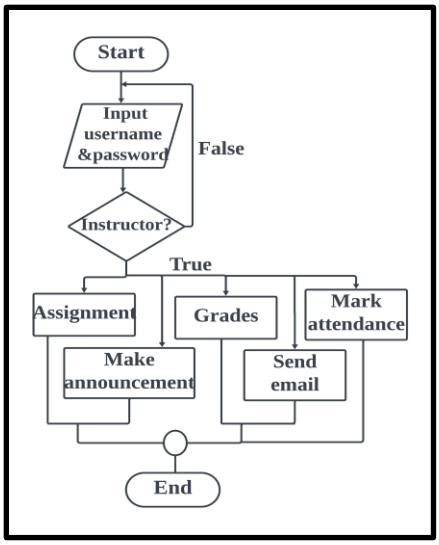


Figure 4.2.6: Flowchart for instructor

This flowchart figure 4.2.6 is for the instructor to make actions according to the features. Instructors can create assignments for the students who are enrolled under them for specific subjects. Grades can be added, edited and updated. Instructors can mark the attendance and send email to the students.

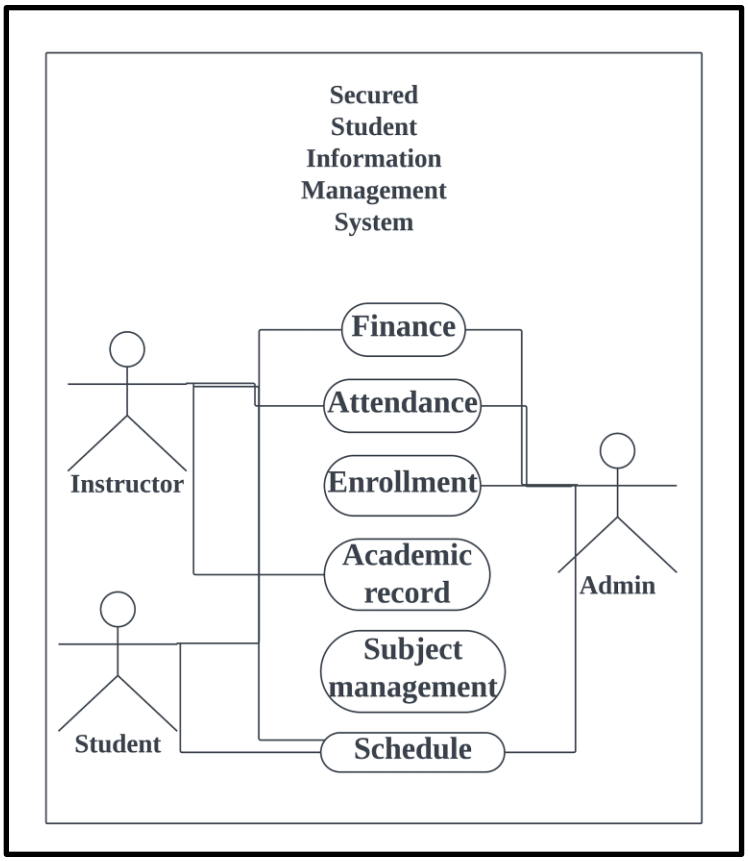


Figure 4.2.7: UML Case Diagram

The figure 4.2.7 effectively showcases the central components of a Secured Student Information Management System and highlights the interactions each user role has with these components. Instructors focus on teaching-related activities, students on their academic and financial activities, and admin on overall system management and maintenance. This structure ensures a well-organized, role specific access to various functionalities within the SIMS, promoting efficiency and security.

4.3 HTTPS Implementation

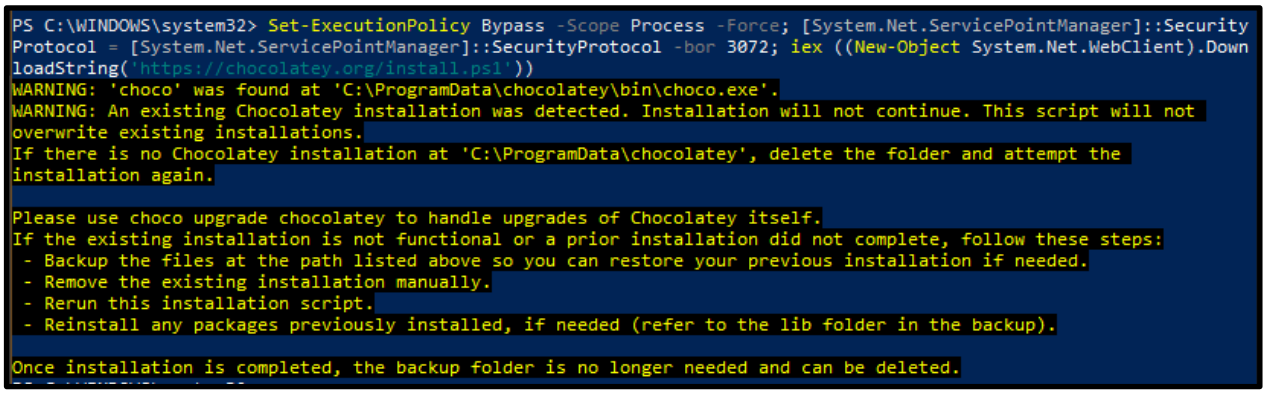


Figure 4.3.1: Install Chocolatey

The figure 4.3.1 is to use this Chocolatey we need to use Windows PowerShell instead of cmd. This is because the Chocolatey installation script is written for PowerShell, making it more reliable to run the command (Set-ExecutionPolicy Bypass -Scope Process -Force) which sets the execution policy to bypass restrictions for the script execution. This command is only for temporary use and only affects the current session. Once the bypass have done then need to run the code to install Chocolatey using ([System.Net.ServicePointManager]::SecurityProtocol = [System.Net.SecurityProtocolType]::Tls12;iex((New-Object System.Net.WebClient).DownloadString('https://community.chocolatey.org/install.ps1'))). This command is to ensure that the script uses the TLS 1.2 protocol for secure downloads.

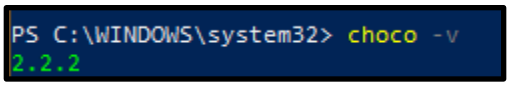


Figure 4.3.2: Chocolatey verification

After the installation is complete, I need to verify whether the Chocolatey installation is successful or not by running the command (choco -v). If the installation is successful, then the version of Chocolatey will be shown here it shows as 2.2.2. The output will be shown as figure 4.3.2.

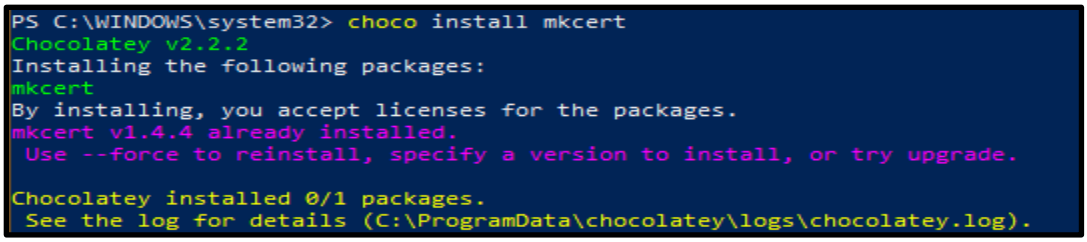


Figure 4.3.3: mkcert installation

In the same command after finding out the version of Chocolatey then need to run the command (choco install mkcert). mkcert is a simple tool to make it easier to develop a system locally with HTTPS from HTTP by generating SSL certificates. The figure 4.3.3 shows the command that used.

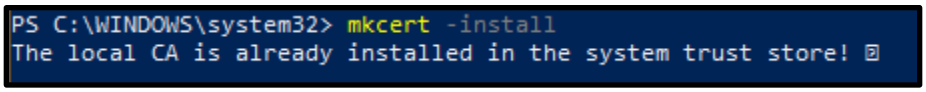


Figure 4.3.4: Install of CA

From figure 4.3.4 we can see that the command generates and install the local CA in the system. CA is a digital certificate authority that is set up and trusted locally on a developer's machine. It is used to provide SSL/TLS certifications for local development to secure communications.

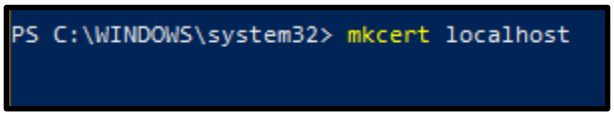


Figure 4.3.5: CA for localhost

To make the SSL work in the Django project, I need to install Django extensions which support the local CA. The installation command is (pip install Django-extensions). And then finally can run the development server with SSL certificate with (python manage.py runserver_plus --cert-file localhost --key-file localhost-key.pem). Once having configured the server to use the generated certificates, then the locally developed system can run over HTTPS. This command generates two files 'localhost.pem' and 'localhost-key.pem'.

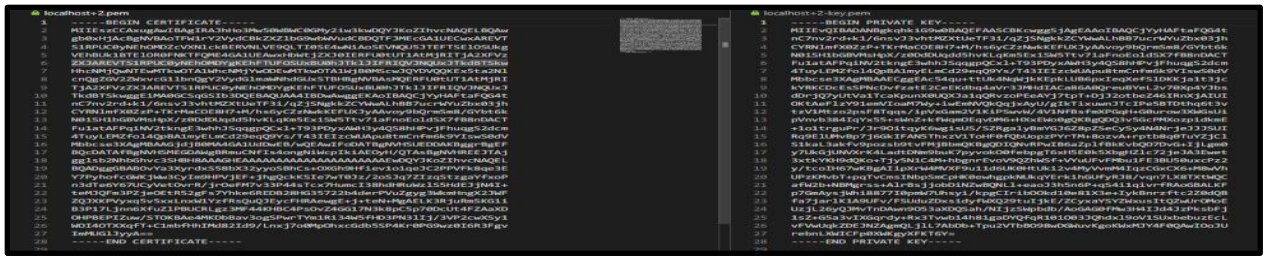


Figure 4.3.6: SSL certificate and the key

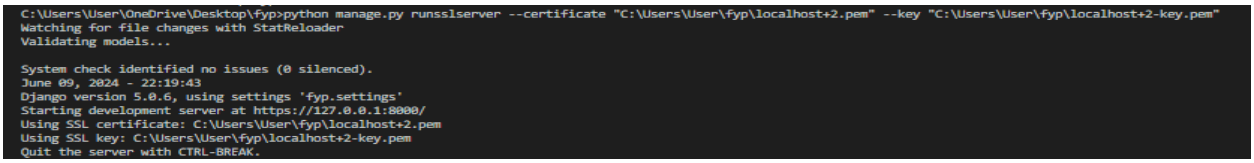


Figure 4.3.7: SSL server running

Figure 4.3.6 and 4.3.7 proves that the system server is successfully running with HTTPS enabled, using the SSL certificate and the responding key. (https://127.0.0.1:8000/) is the URL format to open the server in browsers. HTTPS indicates that the information is secured throughout the sessions while 127.0.0.1 indicates the localhost IP address. '8000' indicates the default port number used by Django's development server.

4.4 Password Hashing

Secured Student Information Management System is built based on Python Django high-level framework. Therefore, Django automatically uses a hashing algorithm for securely saving a user's password in a way it is not readable by anyone for security purposes. When the user creates a password during the registration session, Django's built-in authentication system hashes the password before saving it to the database and makes it encrypted. This ensures that the plaintext is converted into ciphertext by providing a higher-level of security from being compromised by a third party or hacker. By default, the latest version of Django uses the PBKDF2 algorithm with a SHA256 and salt.

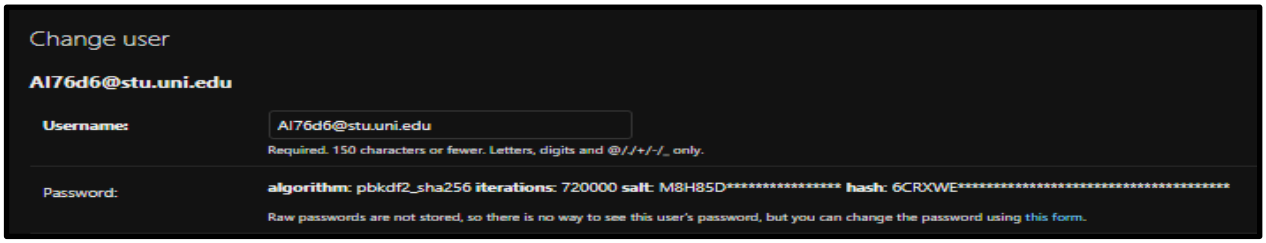


Figure 4.4.1: Password hashing

The figure 4.4.1shows how the password hashing happens in the Django project. The hashed password and username save in the admin site interface only in the database for future extractions.

4.5 Time-out Session Implementation

```
SESSION_EXPIRE_AT_BROWSER_CLOSE = True
SESSION_COOKIE_AGE = 300
SESSION_SAVE_EVERY_REQUEST = True
SESSION_ENGINE = 'django.contrib.sessions.backends.db'
```

Figure 4.5.1: Time-out session implementation

The figure 4.5.1 shows the time out session have applied into the system. This session time-out durations and automatic expiration of URL can help prevent risks related to session hijacking. A user logs into the application, and a session is created with a lifetime of 5 minutes. Every time the user performs an action the time resets the session expiration timer to another 5 minutes. If the user closes the running browser, the session cookie is deleted, and the session is effectively ended. At the same time if the user is inactive for 5 minutes by not performing any actions the session automatically expires and the user will news to login again.

4.6 CSRF protection

The CSRF token is used to protect web systems from Cross-Site Request Forgery attacks. The CSRF token is generated when a user loads a page with a form, and includes it in the form. When the user submits the form, the CSRF token is sent along with the form data, then the system verifies the token with each form submitted. If the token with each form missing or not valid the server rejects the request to load the server.

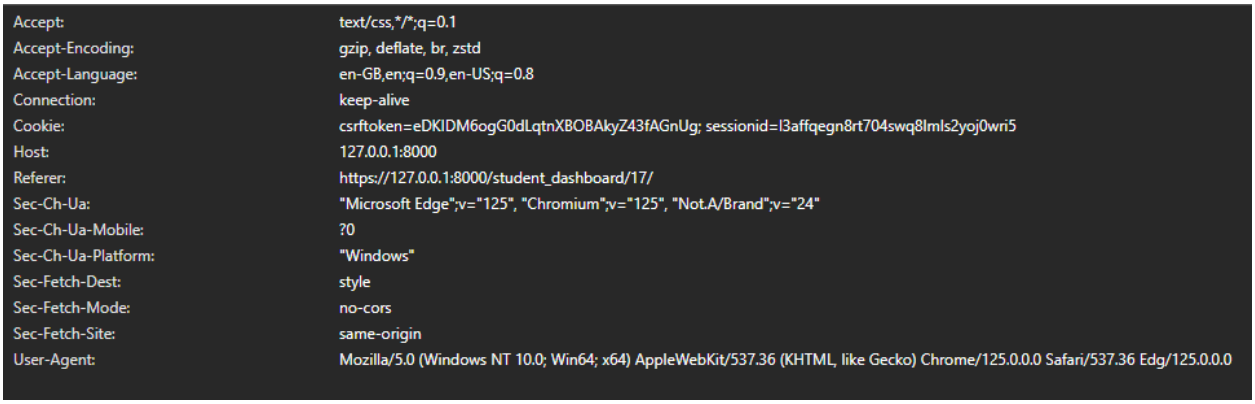


Figure 4.6.1: HTTPS request headers

Figure 4.6.1 shows that the provided the HTTPS request headers for a network request, including the CSRF token and session ID in the cookies. This proves that the CSRF token is being generated and included in the request cookies.

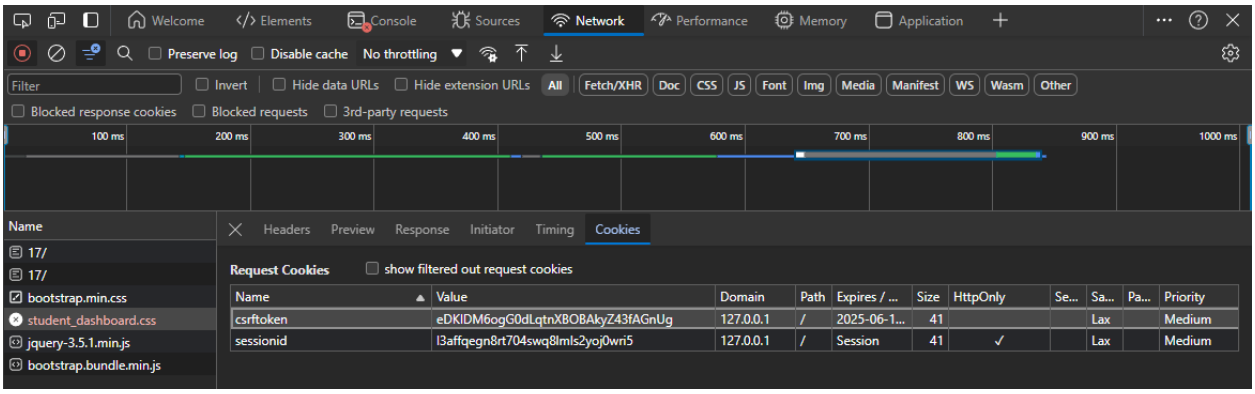


Figure 4.6.2: Cookies is being sent

This figure 4.6.2 shows the cookies being sent with a network request, including the 'csrftoken' cookies. This indicates that the CSRF token is being generated and sent by the server.

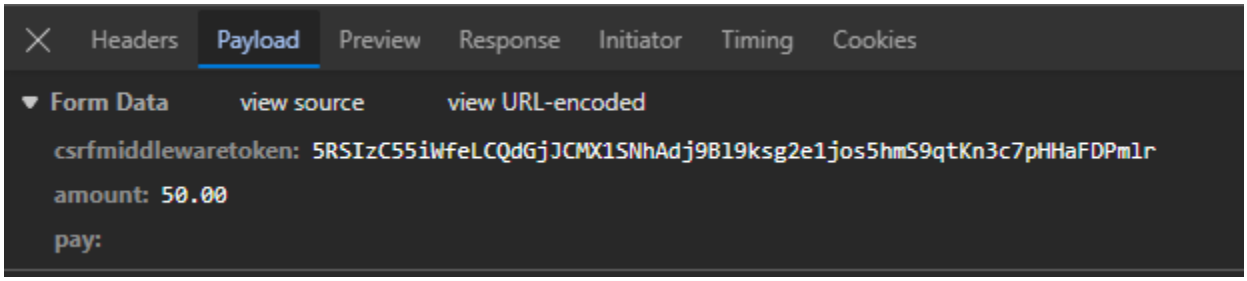


Figure 4.6.3: CSRF in the payload

The figure 4.6.3 shows the form data payload in a network request, which includes the 'csrfmiddlewaretoken'. This indicates that the CSRF token is being correctly included in the form data when the form is submitted. This proves that the generation of CSRF tokens works perfectly.

4.7 Role Based Access Control and Separate URL

RBAC is used for instructors and students while the admin uses different url addresses. The RBAC is decided based on the keyword ‘stu’ for students and ‘acad’ for instructors at the backend which brings to the student dashboard and instructor dashboard respectively. Based on the RBAC the users get to make use of resources which are relevant to their role. Using a separate URL for admin is beneficial in terms of reducing the risks of unauthorized access to important information.

4.8 Database

The Secured Student Information Management System runs in the SQLite3 database. Which is the default database for the Django project. This database is typically used for development because it is a lightweight and easy to configure and handle and fully self-contained. Every data or information is saved in one file inside the project directory called as db.sqlite3. Below is the detailed data dictionary for the models that are applied in the Secured Student Information Management System. Each entry describes data types, descriptions, default values, constraints and usage for their attributes of a model fields.

Table: 4.8.1: Student Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
name	CharField	Student's full name	max_length = 100	None	NOT NULL	Used for displaying the student's name
dob	DataField	Student's date of birth	Date	None	NOT NULL	Used to calculate age or verify identity
faculty	CharField	Name of the faculty	max_length = 100	None	NOT NULL	Used to group students by faculty
major	CharField	Student's major field of study	max_length = 100	None	Optional	Used for academic information
student_id	CharField	Unique identifier for the student	max_length = 10	Auto generated	Unique, Non-editable	Unique ID for each student
university_email	EmailField	Student's university email address	Email	Auto generated	Unique, Optional	Used for official communications

registration_date	DateTimeField	Timestamp of a student registered into the system	DateTime	timezone.now	NOT NULL	Record of when the student was registered

Table 4.8.2: Instructor Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
full_name	CharField	Full name of the instructor	max_length = 100	None	NOT NULL	Display on profile
email	EmailField	Instructor's email address	Email	None	Unique	Used for communication
department	CharField	Department of the instructor	max_length	None	NOT NULL	Used to group instructors

Table 4.8.3: Course Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
code	CharField	Unique code for the course	max_length = 100	None	Unique	Identifier for courses
name	CharField	Name of the course	max_length = 100	None	NOT NULL	Display and identification
credit_hours	IntegerField	Number of credit hours	Integer	None	NOT NULL	Used for academic calculations
instructor	ForeignKey	Instructor teaching the course	ForeignKey	None	NOT NULL	Links course to an instructor

Table 4.8.4: Enrollment Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
course	ForeignKey	Course enrolled	ForeignKey	None	NOT NULL	Links student to the course
student	ForeignKey	Student enrolled	ForeignKey	None	NOT NULL	Links course to students
instructor	ForeignKey	Instructor of the course	ForeignKey	None	NOT NULL	Ensures instructor assigned

Table 4.8.5: Fee Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
course	ForeignKey	Course linked to the fee	ForeignKey	None	NOT NULL	Connects fee to specific course
amount	DecimalField	Fee amount	Decimal	None	NOT NULL	Amount to be paid for the course

Table 4.8.6: StudentFee Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
student	OneToOneField	Link to the student's fee record	OneToOne	None	NOT NULL	Connects each student uniquely to their respective fees

Table 4.8.7: Assignment Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
title	CharField	Title of the assignment	max_length = 100	None	NOT NULL	Identification of the assignment
description	TextField	Detailed description of the assignment	Text	None	NOT NULL	Detailed info on what the assignment entails
due_date	DateTimeField	Deadline for the assignment to be submitted	DateTime	None	NOT NULL	Helps manage when assignments are due
course	ForeignKey	Course related to the assignment	ForeignKey	None	NOT NULL	Links assignment to specific course
instructor	ForeignKey	Instructor assigning the task	ForeignKey	None	NOT NULL	Specifies which instructor created it
reference_document	FileField	File path for any reference documents	File upload	None	Optional	Optional upload for assignment reference

Table 4.8.8: AssignementSubmission Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
assignment	ForeignKey	Assignment to be submitted	ForeignKey	None	NOT NULL	Links to the specific assignment.

student	ForeignKey	Student making the submission	ForeignKey	None	NOT NULL	Identifies student submitting the work
submission_file	FileField	File path for the submitted document	File upload	None	NOT NULL	File upload for students' work
submitted_at	DateTimeField	Submitted timestamp	DateTime	auto_now_add	NOT NULL	Automatically records submission time

Table 4.8.9: Announcement Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
title	CharField	Title of the announcement	max_length = 200	None	NOT NULL	Title for quick reference
content	TextField	Full content of the announcement	Text	None	NOT NULL	Detailed message or notification
instructor	ForeignKey	Instructor issuing the announcement	ForeignKey	None	NOT NULL	Links the announcement to the instructor
created_at	DateTimeField	Timestamp when the announcement was made	DateTime	auto_now_add	NOT NULL	Automatically records creation time

Table 4.8.10: Payment Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
student	ForeignKey	Student making the payment	ForeignKey	None	NOT NULL	Links payment to a specific student
amount	DecimalField	Amount of the payment	Decimal	None	NOT NULL	Specifies ow much was paid
date	DateTimeField	Date when the payment was processed	DateTime	auto_now_add	NOT NULL	Automatically records payment time
transaction_id	CharField	Unique ID for the transaction	max_length = 20	None	Unique	Unique identified for each payment

Table 4.8.11: Grade Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
student	ForeignKey	ForeignKey	None	None	NOT NULL	Links grade to a specific student
course	ForeignKey	ForeignKey	None	None	NOT NULL	Links grade to a specific course
grade	CharField	max_length = 2	None	None	NOT NULL	Records the students's performance

Table 4.8.12: SentEmail Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
sender_student	ForeignKey	Student sender of the email	ForeignKey	None	Optional	Email sent by a student
sender_instructor	ForeignKey	Instructor sender of the email	ForeignKey	None	Optional	Email sent by an instructor
recipient_student	ForeignKey	Student recipient of the email	ForeignKey	None	Optional	Email received by a student
recipient_instructor	ForeignKey	Instructor recipient of the email	ForeignKey	None	Optional	Email received by an instructor
recipinet_email	EmailField	Email address of the recipient	Email	None	Optional	Direct email address
subject	CharField	Subject of the sent email	max_length = 100	None	NOT NULL	Brief topic of the email
message	TextField	Main content of the email	Text	None	NOT NULL	Full message content
sent_at	DateTimeField	Timestamp when the email was sent	DateTime	auto_neow_add	NOT NULL	Automatically record the sending time

Table 4.8.13: Notification Model

Field name	Data type	Description	Format	Default value	Constraints	Usage
student	ForeignK	Student	ForeignKey	None	Optional	Specific

	ey	linked to the notification				student the notification is for
instructor	ForeignKey	Instructor linked to the notification	ForeignKey	None	Optional	Specific instructor the notification is for
subject	CharField	Subject or title of the notification	max_length = 255	None	NOT NULL	Brief title of the notification
message	TextField	Content of the notification	Text	None	NOT NULL	Detailed information within the notification
created_at	DateTimeField	Timestamp when the notification was created	DateTime	auto_now_add	NOT NULL	Automatically records creation time
is_read	BooleanField	Status to check if notification is read	Boolean	False	NOT NULL	Indicates if notification has been seen

4.9 Penetration Testing

Penetration testing is known as pen testing or ethical hacking is a method used to evaluate the security of an information system by stimulating an attack from malicious outsiders which commonly known as hackers or attackers and insiders (employees). The information is analyzed to find vulnerabilities and discover the ways to solve the issues. To conduct the penetration testing for the Secured Student Information Management System I used a Kali Linux as a virtual machine, which can run inside the host machine as a guest operating system.

Kali Linux is a specialized Linux distribution used for digital forensics and penetration testing. It is based on Debian and is maintained and funded by Offensive Security. By default, Django development server listens on '127.0.0.1' (localhost) and not on external IP address and needs to make the Django server listen on all available network interfaces.

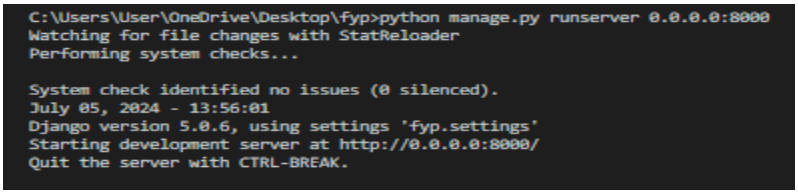


Figure 4.9.1: Listen all network

Figure 4.9.1 shows the command 'python manage.py run server 0.0.0.0:8000' is used to run the Secured Student Information Management System server not just in the localhost '127.0.0.1:8000'. But this command will produce an error says that 'The address '0.0.0.0' is not valid web address to access from a browser. Because it is a special address that tells the server to listen on all available IP addresses. To access the Django server, need to use the actual IP address of the machine. Since the host machine IP address is '192.168.100.6' which can obtain from the below command. After obtaining the host IP address need to access the Django server from Browser using

'http://192.168.100.6:8000/' then can perform the penetration testing from the Kali virtual machine.

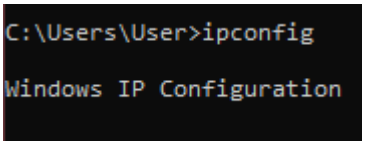


Figure 4.9.2: Ipconfig

Figure 4.9.2 shows the method to know the IP address. This command is used in the host machine in this case the host machine is Windows to obtain the machine's IP address.

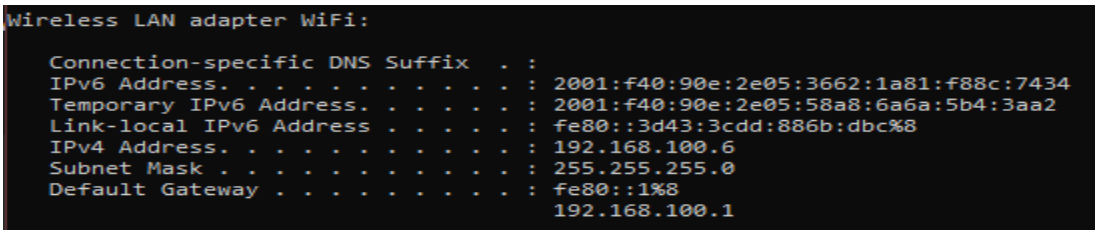


Figure 4.9.3: IP address

Based on the figure 4.9.3 shows the machine's IPv4 (192.168.100.6) and IPv6 (2001: f40:90e:2e05:58a8:6a6a:5b4:3aa2). To perform the penetration testing IPv4 is needed rather than IPv6.

NIKTO Testing

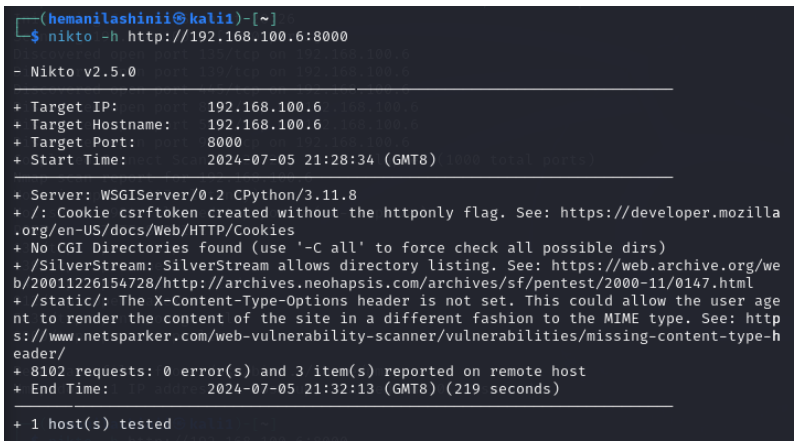


Figure 4.9.4: Nikto

From the figure 4.94 shows the Nikto scan results indicate a few potential issues with the Django application setup.

a. Cookie without HttpOnly Flag
    i. The “csrftoken” cookie is created without the “HttpOnly” flag. This flag helps prevent client-side scripts from accessing the cookie, providing a layer of protection against XSS attacks.
    ii. To solve the problem inside the Django ‘setting.py’ file need to set the ‘HttpOnly’ flag for the ‘csrftoken’ cookie by adding or updating the following line ‘CSRF_COOKIE_HTTPONLY = True’

b. Missing X-Content-Type-Options-Header
    i. The ‘X-Content-Type-Options’ header is not set for the ‘/static’ directory. This header helps prevent browsers from interpreting files as a different MIME type than what is specified, reducing the risk of certain types of attacks

ii. To solve the issue ‘X-Content-Type-Options: nosniff’ header must add into the ‘setting.py’ file. For Django we can use the built-in security middleware to add this header 'django.middleware.security.SecurityMiddleware'

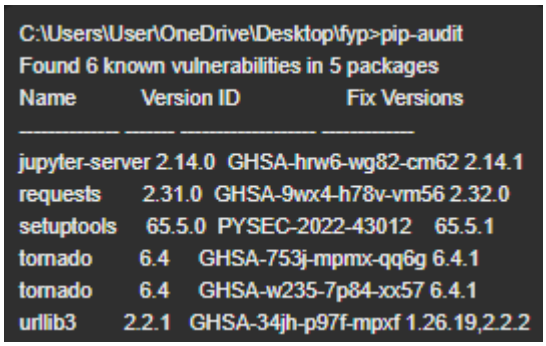


Figure 4.9.5: Pip-audit

The figure 4.9.5 shows the General Security Recommendations. Ensures all the packages and dependencies for Python and Django are up to date. To make sure that we can use the above command. From the above figure we can see that some of the packages need to update.

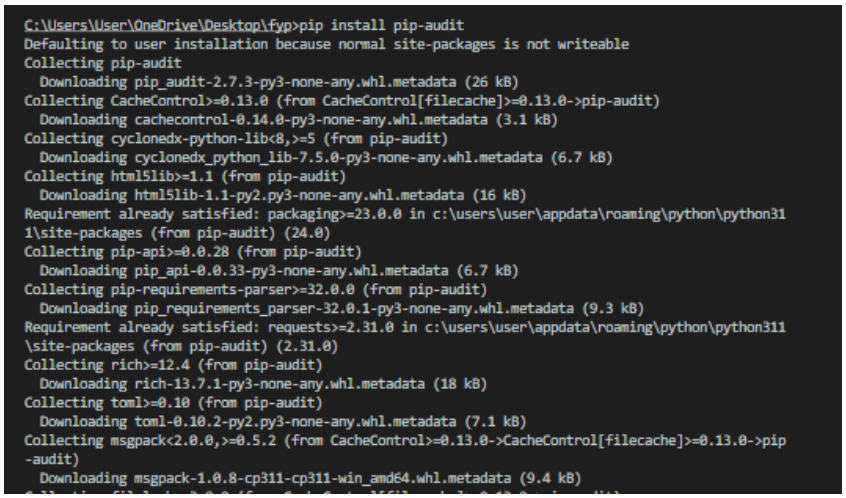


Figure 4.9.6: Pip install pip-audit

The above figure 4.9.6 shows the method to make necessary upgrades for a system. To update the vulnerable packages which can be a threat for the system need to run the command 'pip install --upgrade jupyter-server==2.14.1 requests==2.32.0 setuptools==65.5.1 tornado==6.4.1 urllib3==2.2.2'. This command will update the affected package to their fixed versions as recommend in the previous image.

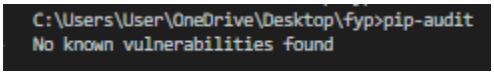


Figure 4.9.7: Re-run 'pip-audit'

To make sure that all the packages are free from vulnerable need to re-run the command 'pip-audit'. 'No known vulnerabilities found' confirms that all the packages have been updated to the fixed versions.

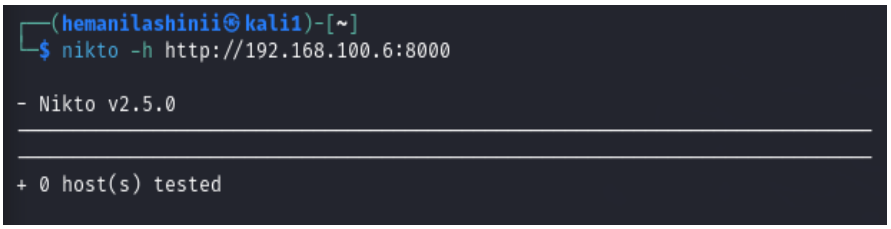


Figure 4.9.8: Re-run Nikto

Based on this figure 4.9.8 Nikto did not detect any vulnerabilities or issues during the scan because;

a. Application configuration
    i. The Django application which is the Secured Student Information Management System have been configured securely with proper headers and settings that mitigate common vulnerabilities

b. Network Configuration
    i. Ensure that Nikto was able to reach the application server (‘192.168.100.6:8000’) and that there were no network issues during the scan.

OWASP ZAP Testing

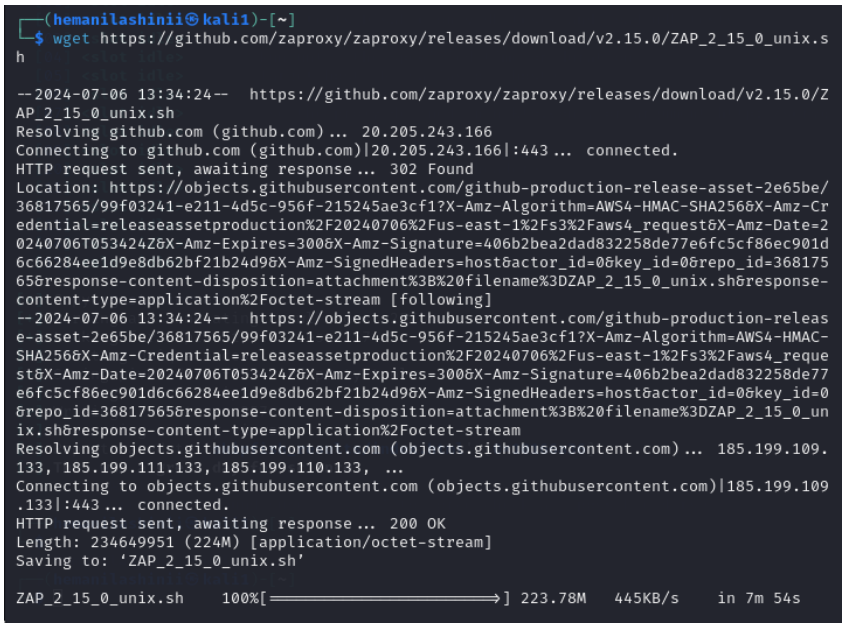


Figure 4.9.9: OWASP ZAP installation

The command "wget https://github.com/zaproxy/zaproxy/releases/download/v2.15.0/ZAP_2_15_0_unix.sh" as shown in the Figure 4.9.9 is used to download the latest version of OWASP ZAP from their official website for Linux because Kali is product of Linux.

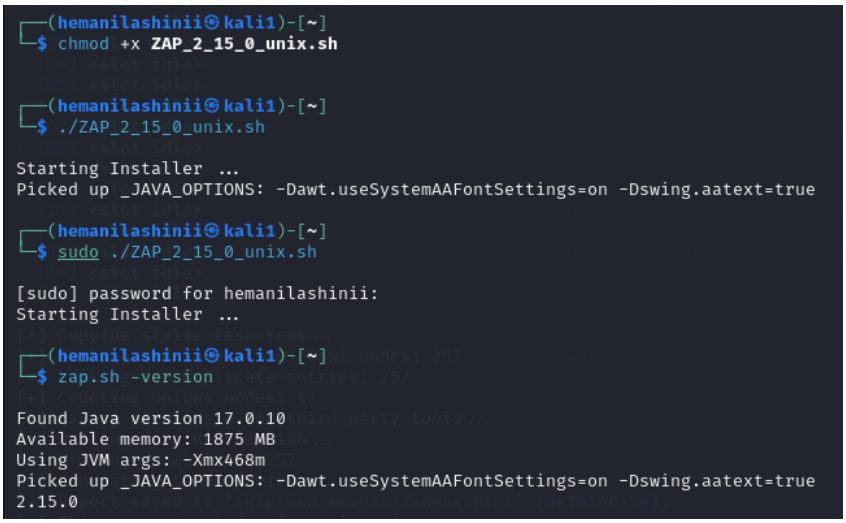


Figure 4.9.10: Complete installation of OWASP ZAP

Figure 4.9.10 shows the command that must be performed to complete the installation of the penetration tool. After downloading the latest OWASP ZAP version the script need to make as executable by running the command “chmod +x ZAP_2_15_0_unix.sh”. To run the executable installer script needs to run this command “ ./ZAP_2_15_0_unix.sh” while inserting the keyword called “sudo” which gives the root privilege as a superuser. Once the installation is done we have to verify the it by running the “zap.sh -version” command to confirm that the OWASP ZAP have been downloaded successfully with latest version.

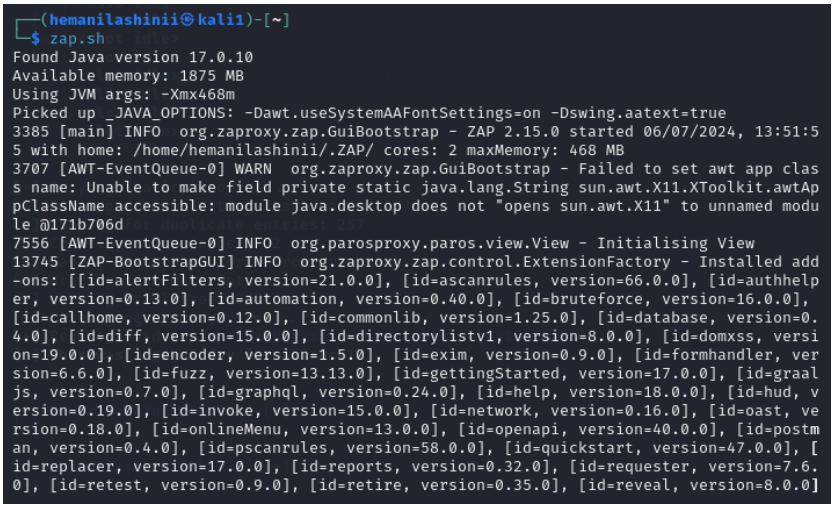


Figure 4.9.11: Run the OWASP ZAP tool

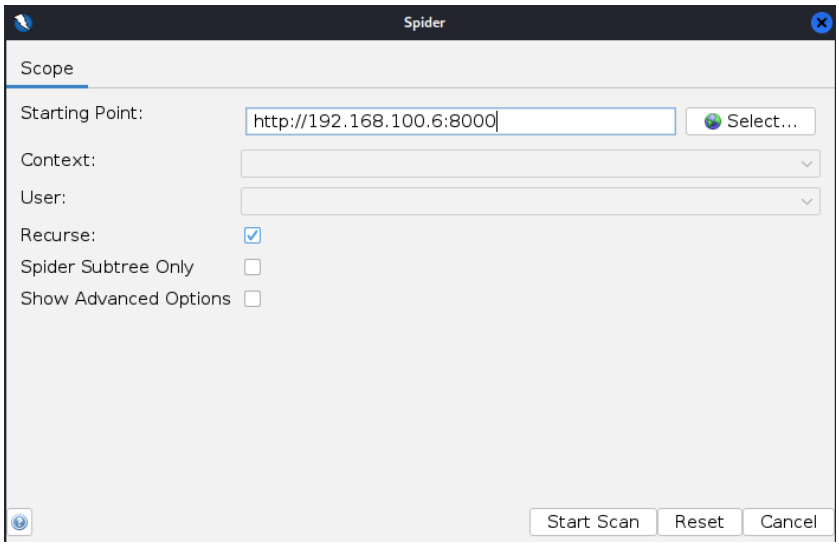


Figure 4.9.12: Starting point

Figure 4.9.11 and 4.9.12 shows one of the testing tool “Spider” in which provided by the OWASP ZAP. It is an open-source web application security testing tool to help developers, security testers, and penetration testers to identify vulnerabilities and security flaws in the web application in this case it used to scan the Secured Student Information Management System.

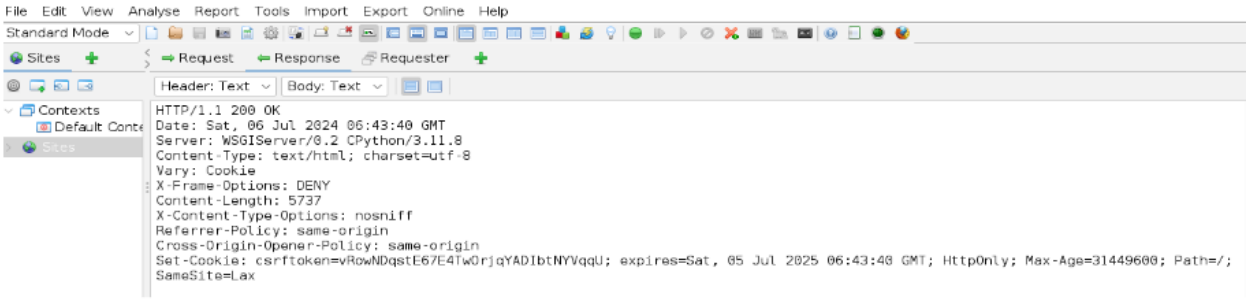


Figure 4.9.13: HTTP Response

From the figure 4.9.13 shows the response header information provides details about the HTTP response from the Django server which runs the Secured Student Information Management System. Here is the breakdown of each port:

I. HTTP/1.1 200 OK: This indicates that the request was successful, and the server is returning the requested resource.

II. Server: WSGI Server/0.2 CPython/3.11.8: Information about the server software. In this case, it indicates that the server is using WSGIServer version 0.2 with CPython 3.11.8

III. Content-Type: text/html; charset=utf-8: The MIME type of the returned content, which is HTML with UTF-8-character encoding

IV. Vary: Cookies: Indicates that the response varies based on the value of the Cookie header in the request

V. X-Frame-Options: DENY: This prevents the webpage from being framed or embedded by other pages, which helps to protect against clickjacking attacks

VI. Cross-Origin-Opener-Policy:same-origin: This instructs the browser to isolate the browsing context group to the same origin, which helps to mitigate side-channel attacks

VII. Set-Cookie: csrftoken=vRowNDqstE67E4TwOrjqYADIbtNYVqqU; expires=Sat, 05 Jul 2025 06:43:40 GMT; HttpOnly; Max-Age=31449600; Path=/; SameSite=Lax: This sets a cookie named csrftoken with the value vRowNDqstE67E4TwOrjqYADIbtNYVqqU.
The cookie has several attributes:

- expires=Sat, 05 Jul 2025 06:43:40 GMT: The expiration date of the cookie.
- HttpOnly: This attribute makes the cookie inaccessible to JavaScript, which helps to protect against cross-site scripting (XSS) attacks.
- Max-Age=31449600: The maximum age of the cookie in seconds.
- Path=/: The cookie is valid for the entire domain.
- SameSite=Lax: This attribute helps to mitigate cross-site request forgery (CSRF) attacks by restricting when cookies are sent with cross-site requests.

Based on the HTTP response headers, the website has several security measures in place. Here is a detailed analysis:

a. X-Frame-Options: DENY
    i. This prevents the webpage from being framed, which helps to protect against clickjacking attacks

b. X-Content-Type-Options: nosniff
    i. This prevents browsers from interpreting files as a different MIME type to what is specified in the Content-Type-Header, which helps to mitigate MIME type confusion attack. This is a type of attack which are cyberattacks that exploit the MIME sniffing algorithm to inject malicious code

c. Referrer-Policy: same-origin
    i. This instructs browsers to only send the referrer header if the request is to the same origin as the current document, which can help protect sensitive information from being sent to external sites.

d. Cross-Origin-Opener-Policy: same-origin
    i. This helps to mitigate side-channel attacks by isolating the browsing context group to the same origin

e. Set-Cookie with HttpOnly and SameSite attributes
    i. ‘HttpOnly’: This makes the cookie inaccessible to JavaScript, which helps protect against cross-site scripting (XSS) attacks
    ii. ‘SameSite=Lax’: This helps mitigate cross-site request forgery (CSRF) attacks by restricting when cookies are sent with cross-site requests

OWASP ZAP REPORT

About this report

Report parameters

Contexts

No contexts were selected, so all contexts were included by default.

Sites

The following sites were included:

- http://192.168.100.6:8000

(If no sites were selected, all sites were included by default.)

An included site must also be within one of the included contexts for its data to be included in the report.

Risk levels

Included: High, Medium, Low, Informational

Excluded: None

Confidence levels

Included: User Confirmed, High, Medium, Low

Excluded: User Confirmed, High, Medium, Low, False Positive

Figure 4.9.14: ZAP testing report

Figure 4.9.14 shows the “About this report” section provides details about the parameters and scope of the security scan that was performed. Here’s a breakdown of the key points:

Contexts

- No contexts were selected, so all contexts were included by default. This means that the scan did not focus on specific user-defined contexts or areas of the site. Instead, the entire site was included in the scan

Sites

- http://192.168.100.6:8000 is the IP address and port of the site that was scanned. It indicates that the scan targeted a local server running on port 8000

- If the IP and port number were not specified then the OWASP ZAP tool would scan all reachable sites within the defined context, which in this case is just the specified IP and Port

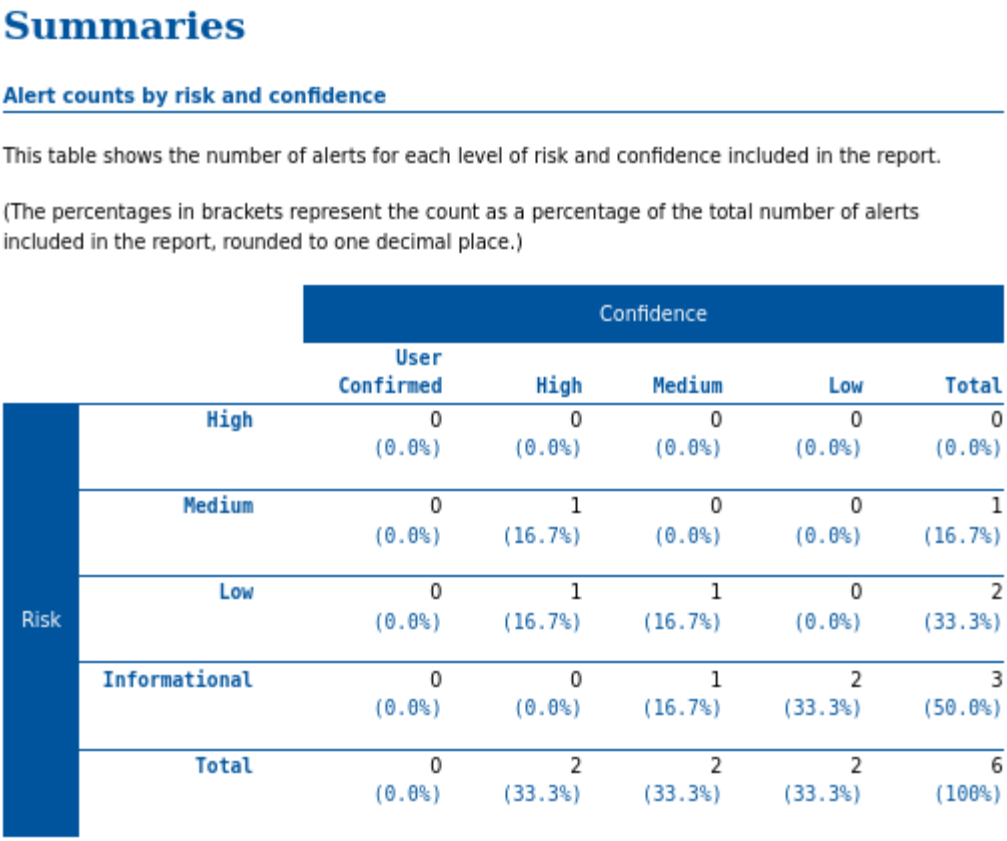
Risk Level

- Included High, Medium, Low and Informational
- The scan included all levels of risk. This means that the report contains findings categorized as high, medium, low and informational risks
- None is the excluded risks which indicates no risk levels were excluded from the scan

Confidence Level

- The scan included findings with varying levels of confidence. “User Confirmed” refers to findings that a user has verified as accurate. High, medium and low indicate the scanner’s confidence in the accuracy of the findings

This report provides a comprehensive overview of potential security issues for the site hosted at http://192.168.100.6:8000 which is used to run the Secured Student Information Management System. The scan did not limit its scope by context, site, risk level or confidence level, ensuring a through examination.



Summaries

Alert counts by risk and confidence

This table shows the number of alerts for each level of risk and confidence included in the report.

(The percentages in brackets represent the count as a percentage of the total number of alerts included in the report, rounded to one decimal place.)

		Confidence				
		User Confirmed	High	Medium	Low	Total
Risk	High	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
	Medium	0 (0.0%)	1 (16.7%)	0 (0.0%)	0 (0.0%)	1 (16.7%)
	Low	0 (0.0%)	1 (16.7%)	1 (16.7%)	0 (0.0%)	2 (33.3%)
	Informational	0 (0.0%)	0 (0.0%)	1 (16.7%)	2 (33.3%)	3 (50.0%)
	Total	0 (0.0%)	2 (33.3%)	2 (33.3%)	2 (33.3%)	6 (100%)

Figure 4.9.15: Summaries

Figure 4.9.15 provides the “Summaries” section provides an overview of the alerts found during the scan, categorized by risk and confidence levels. There are total of 6 alerts: medium risk (1), low risk (2) and informational risk (3). There were no high risk or user confirmed alerts. Although informational risk is part of alerts but it’s not a form of vulnerabilities, but it is an useful information about the system’s configuration and behavior which do not pose an immediate threat or vulnerability. The absence of high-risk alerts is positive, but medium and low risks issues should be addressed to ensure the security of the application.

4.10 Summary

In summary, this chapter 4 Implementation discusses the implementation that has been done in terms of flow of the system, DFD and the UML case diagram with actors and actions can be made by them. Apart from that this chapter also discusses about security measures and how the HTTPS have implemented to the system, how does the hashing passwords works, time-out session for the system to stay alive to prevent from session hijacking attacks, and the CSRF token generation and what does the generated token does to the system. Implementing more security measures in a system makes the server to be more secure and free from being hacked by outsiders or even from internal parties. Therefore, after performing all these security functions, we were able to develop a Secured Student Information Management System making it safe for the users to use it. Moreover, the detailed information of database has also been discussed in this chapter about the type of database used which is the SQLite 3 and the data dictionary which shows information about field name, data type, description, format, default, constrains and usage in the context of Secured Student Information Management System.

CHAPTER 5

TESTING AND DISCUSSION

5.1 Overview

The chapter Testing and Discussion is an important section of the software development process, ensuring that the system functions work perfectly fine and according to the users actions. Testing is the process of evaluating a system or its components to determine whether it satisfies specified requirements. It involves executing the software to find any errors or missing steps or requirements and rectifying the problems.

5.2 Interface Testing

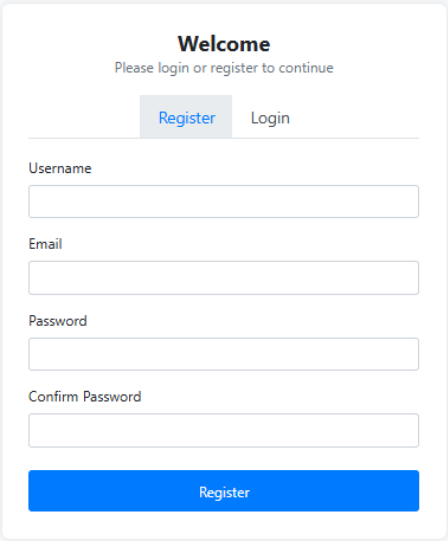


Figure 5.2.1: Register page

Figure 5.2.1 shows the register page for instructor and student. Username is self-entered input whereas email is provided by the admin upon registering to the system for the first time. If the entered email is not in the database, then automatically the user cannot save the password and cannot login to the system. If the email is present in the database then the user can successfully enter the password. Then the password will be hashed before saving into the database.

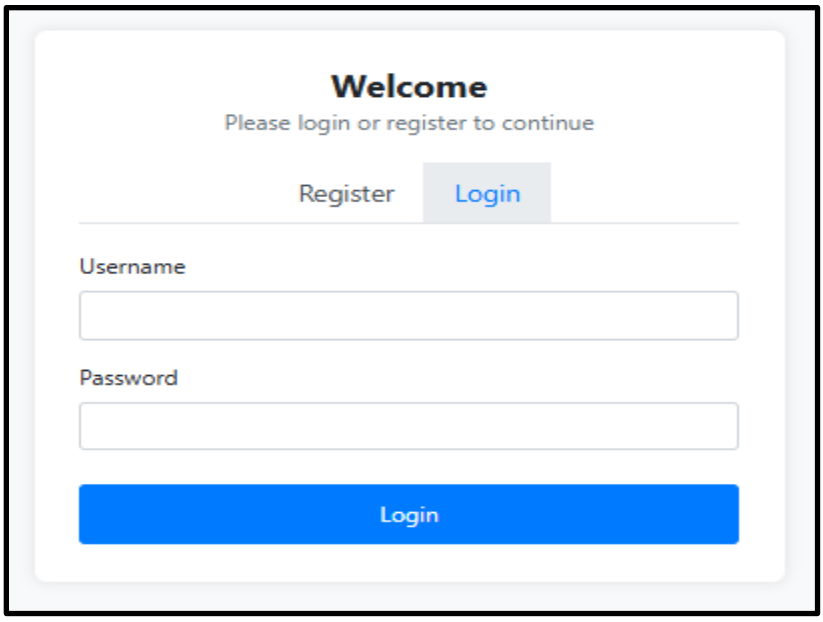


Figure 5.2.2: Login page

The figure 5.2.2 shows the login page with Username which is the email address and along with the Password. Once the password matches the username, the system will grant the authorization to use it. The authorization is given based on the RBAC which means Role Based Authentication Control. If the username contains the keyword 'stu' for example (AI76d6@stu.uni.edu) it will treat this user as a student therefore it is brought to the student dashboard. While, for an instructor if the username contains the word 'acad' for example (sam@acad.uni.edu) brings to the instructor dashboard.

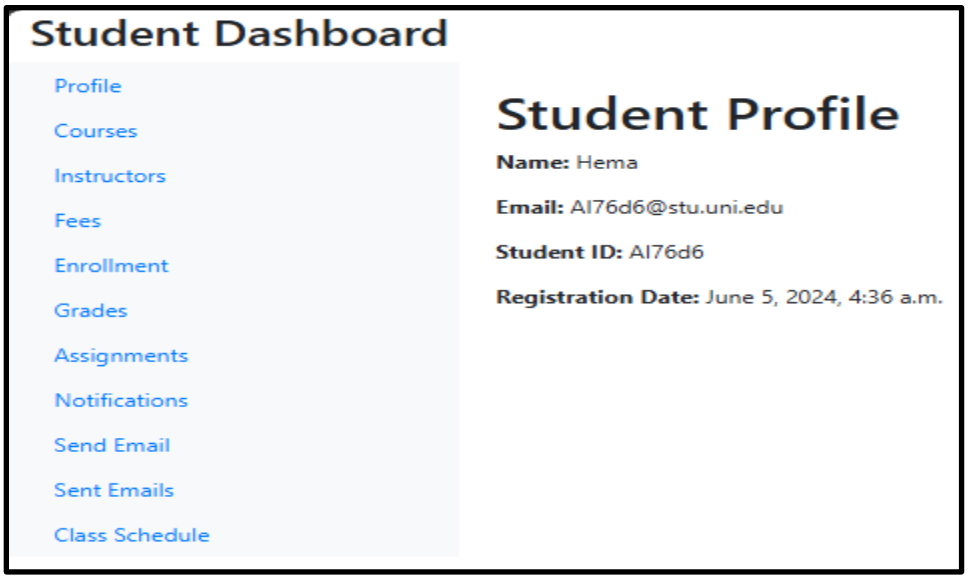


Figure 5.2.3: Student dashboard

The figure 5.2.3shows the page for the student user. The contents in the 'Profile' section shows the name, email address and the student ID plus the registration date when a new student has been added to the database in the admin site. The sidebar shows the features that a student can access.

Figure 5.2.4: Course

The figure 5.2.4 shows the section for the list of courses the student has been enrolled into through admin or self-enrollment.

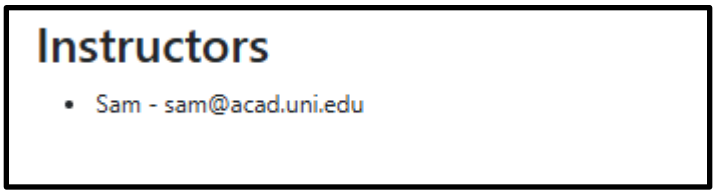


Figure 5.2.5: Instructor

The figure 5.2.5 shows the list of instructors, the student has been enrolled based on the subjects they have enrolled

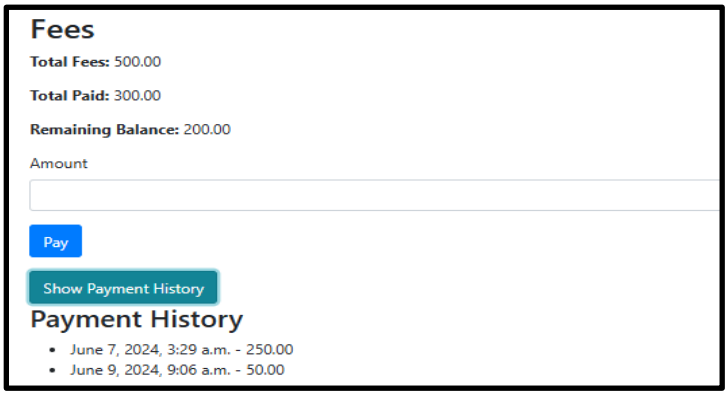


Figure 5.2.6: Fees Payment

In the figure 5.2.6 shows the student can view their total amount of fees, total paid and the remaining amount that needs to be paid. At the same time the student can make the payment and view their payment history for any further references. Once the payment has been done automatically will happen in the admin site to keep track of the students financial information.

Figure 5.2.7: Enrollment

Figure 5.2.7 is useful for students to enroll for subjects themselves and the update will be automatically done in the admin site. The student is not allowed to enroll in the subject registered under their name.

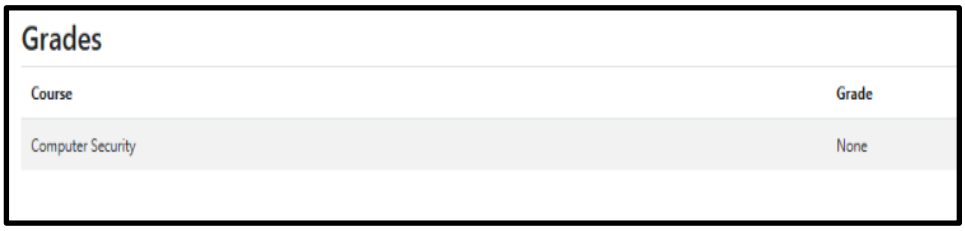


Figure 5.2.8: Grade

Figure 5.2.8, the student can view their grades updated by the instructor for a subject. The 'None' shows that the instructor has not updated the grade for the respective student.

Figure 5.2.9: Notifications

This figure 5.2.9 shows the notification whenever an instructor sends an email and makes an announcement for a student. After reading the announcement the student can press the 'Mar as Read' button and after reading the student either can delete or keep it as long as they want.

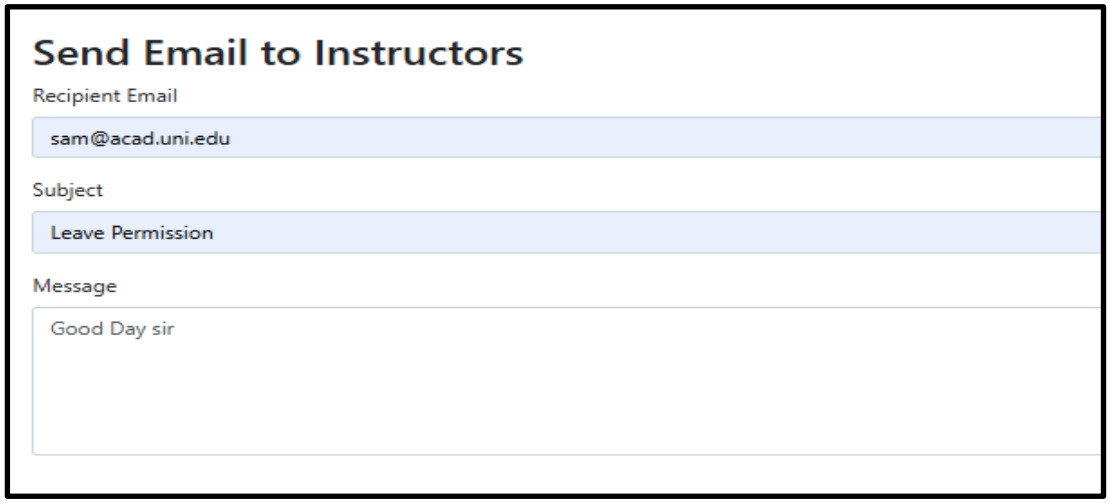


Figure 5.2.10: Send email

In this page the student can send an email to a particular instructor by typing manually an instructor email address. After completing the typing the cursor must be placed inside the 'Message' box and then hit the 'Enter' key in the keyboard to successfully send the email if the student wants to move to the new line, then the user must press the 'Shift' together with the 'Enter' key.

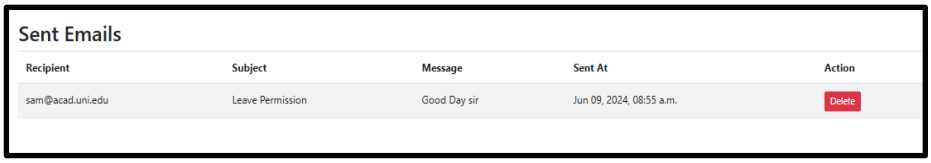


Figure 5.2.11: Sent email

Figure 5.2.11 shows the list of sent email with the recipient, subject, message and sent at field and plus with the 'Delete' button where the students can delete the sent email if they want to.

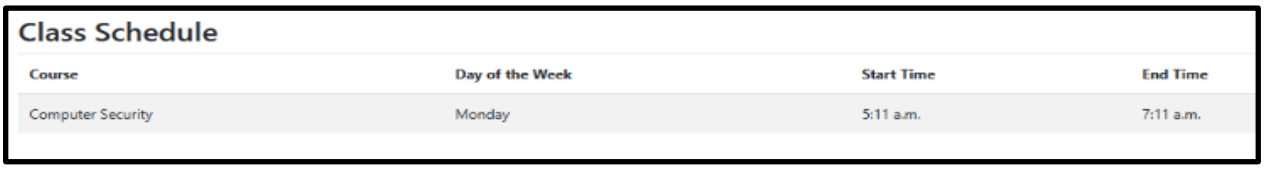


Figure 5.2.12: Class schedule

The figure 5.2.12 shows the class schedule information is retrieved from the admin site. The class schedule appears if the student is enrolled into that certain class otherwise it would not appear in the class schedule section in the student dashboard.

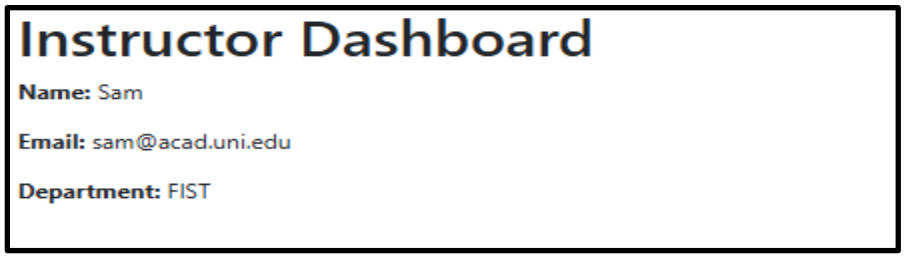


Figure 5.2.13: Instructor dashboard

The figure 5.2.13 shows the name, email address and the department they are teaching the students.

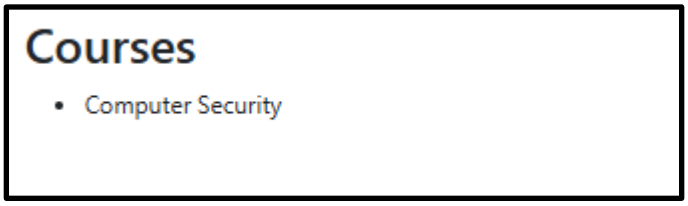


Figure 5.2.14: Courses

Figure 5.2.14 shows the list of course names where an instructor has been added to a particular subject in the administration site.

Figure 5.2.15: Enrolled students

Figure 5.2.15 shows the instructor to view the students enrolled under a specific instructor. This page includes the student's name, student id, course and the student email address.

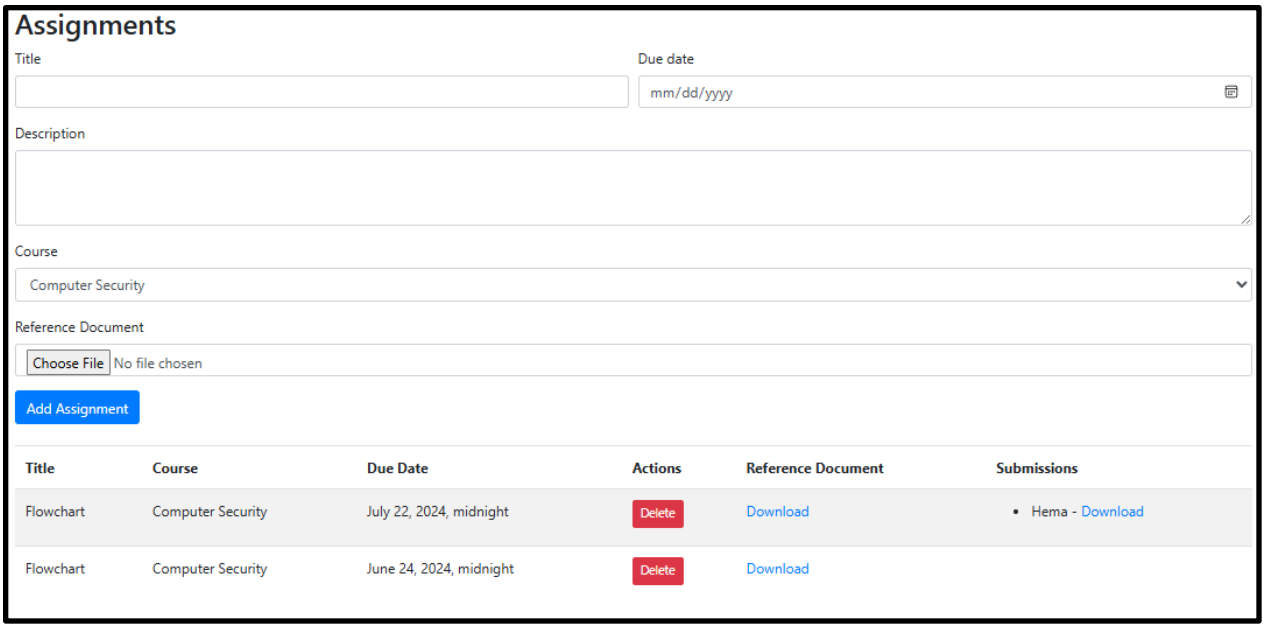


Figure 5.2.16: Assignment

Figure 5.2.16 is for the instructor to give an assignment for the student and the instructor also can choose a file from their device for student's reference. Below the assignment assigning section, the instructor can view the submitted assignment and download the file from the student to assess it.

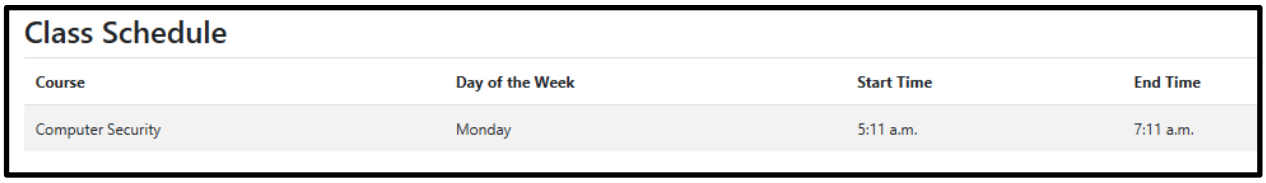


Figure 5.2.17: Class schedule

Figure 5.2.17 shows it has the course name, day of the week, start and end time. From this page, the instructor can view the timetable for their classes. The schedule is adjusted by the admin in the administration page.

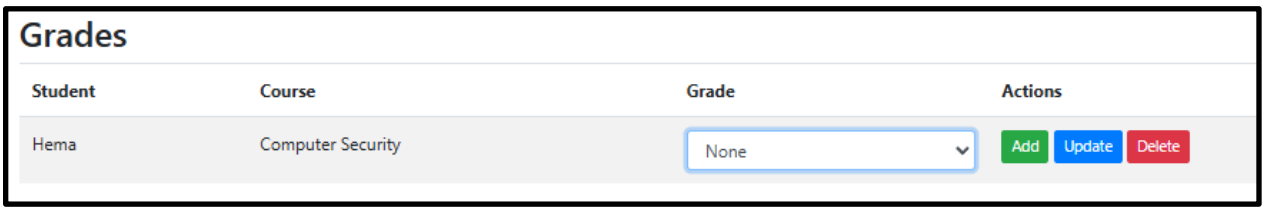


Figure 5.2.18: Grades

Figure 5.2.18 is for grades section is used for adding, updating and deleting the grades according to the student's name and course. There are six types of grade options which are A, B, C, D, F, and None. If the instructor adding grades for a student for the first time then the 'Add' button must be pressed, after that if the instructor would like to change the grades means need to press the 'Update' button and the 'Delete' button to delete the current grade and changes into ' None' word in the instructor dashboard while in the student dashboard does not show anything.

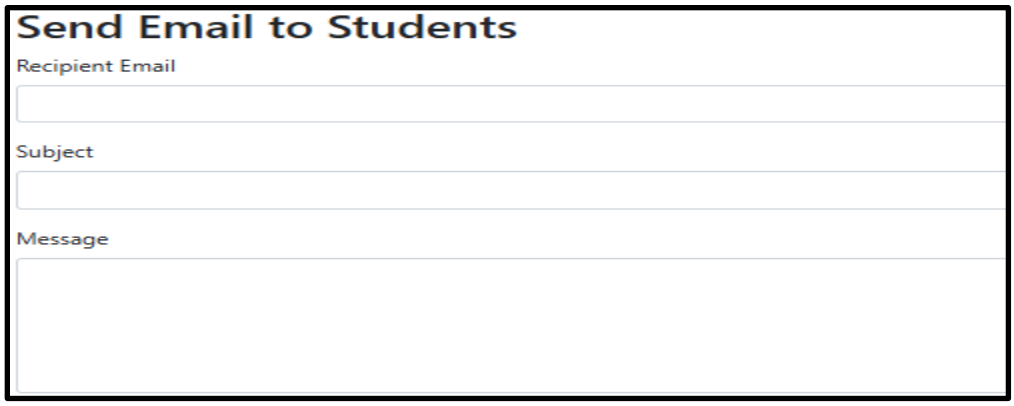


Figure 5.2.19: Send email

Figure 5.2.19 shows for instructors to send email to students. In the recipient email the instructor can manually enter the email address; for the email address they can get it from the 'Notifications' sections where an email is sent to the instructor. This send email to students is kind of replying back in another section not straight from the 'Notification' section.

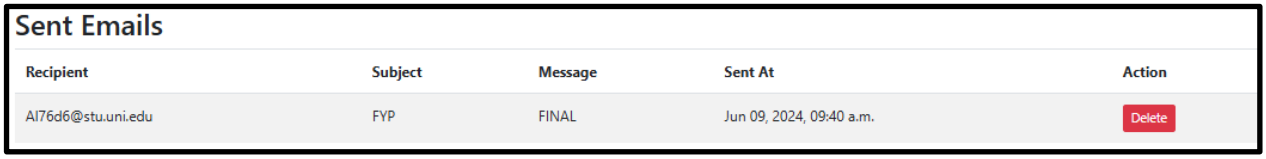


Figure 5.2.20: Sent emails

Figure 5.2.20 is for the instructor's reference for viewing with the sent email for students and the users can delete the emails. In this section the instructor can see the receiver's email address, subject, the content of message and the time when the message sent by the instructor.

Figure 5.2.21: Make announcement

Figure 5.2.21 shows that the system allows the instructor to make announcements for all the students. When the announcement has been made, it will be sent to the student's 'Notifications' section where the students will be able to view the announcement.

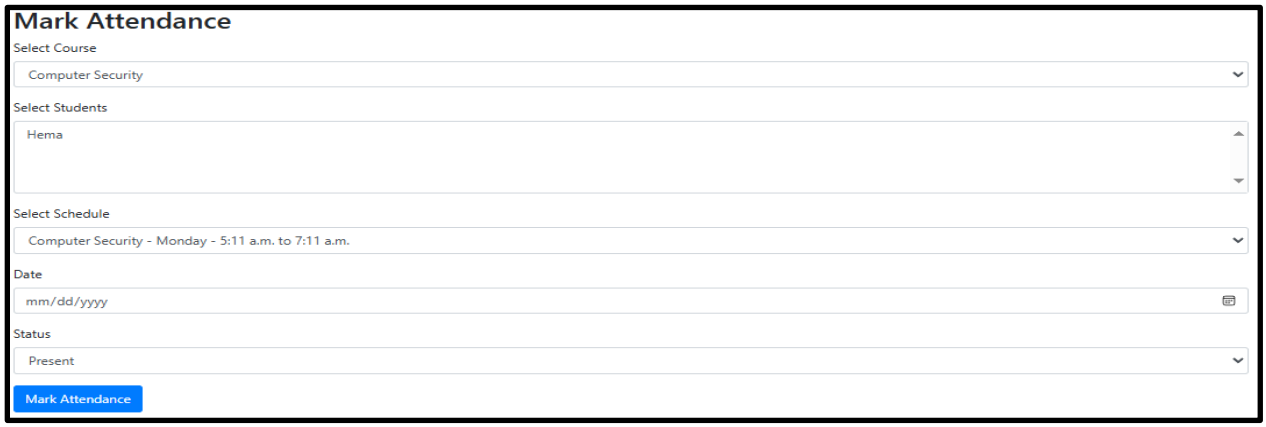


Figure 5.2.22: Mark attendance

Figure 5.2.22 is for instructors to perform attendance marking with the option of selecting course, selecting multiple students in one go, selecting schedule if the time needs to match with the course type, the current date of having the class and selecting the status between 'Present' and 'Absent'. If the student is in the class, then go for 'Present' if not 'Absent' and then finally press, 'Mark Attendance' button to save it to the 'Attendance Record' and automatically the attendance will be saved in the admin site.

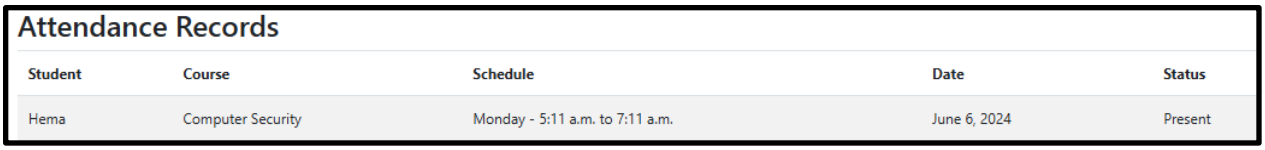


Figure 5.2.23: Attendance record

Figure 5.2.23 is used to record student's attendance based on the subject, class schedule and status whether he/she is present or absent for that day and time of the class.

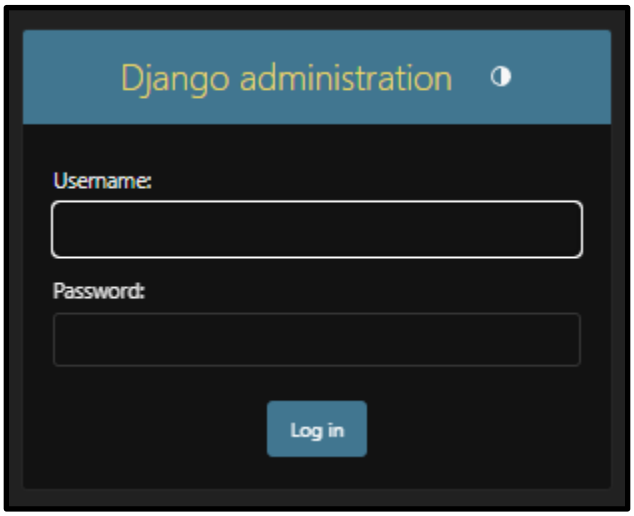


Figure 5.2.24: Django admin

Figure 5.2.24 is used by the admin to get access to the admin site by entering the username and matching password.

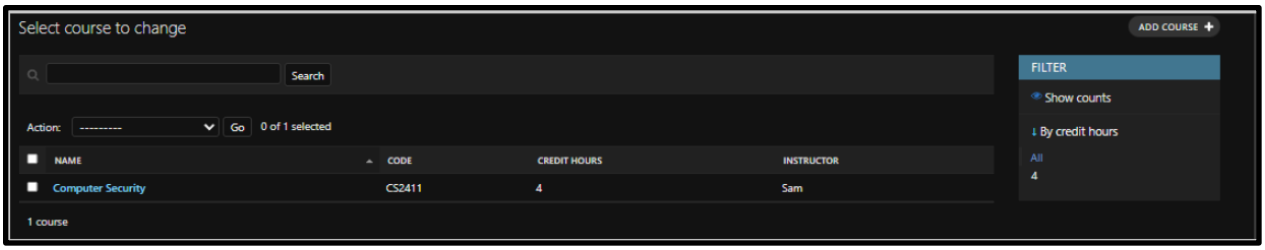


Figure 5.2.25: Course

Figure 5.2.25 in this page the admin can view the list of courses that have been added into the database.

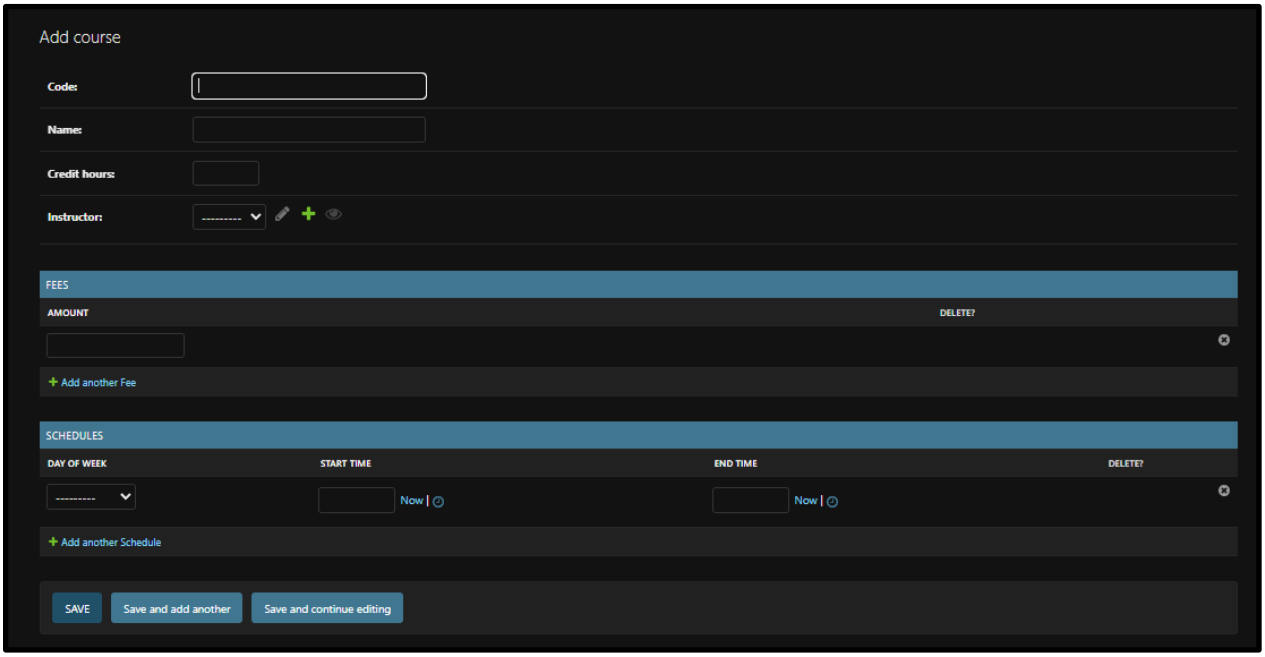


Figure 5.2.26: Add course

Figure 5.2.26 shows the page the admin allowed to add new courses by filling up the Code, Name, Credit Hour, and Instructor. At the same time, the admin can add in the teaching amount for that course and adjust the scheduling. After creating the course, in the instructor dashboard, the instructor will see the name of the course they have been assigned and the schedule for that

subject. Whereas in the student dashboard, if the student enrolled into newly created subject, then the name of the course will be added into the course section and the amount of fees will be also update according to the amount have assigned for that subject by the admin and the student can view the schedule for enrolled subject which also adjusted by the admin.

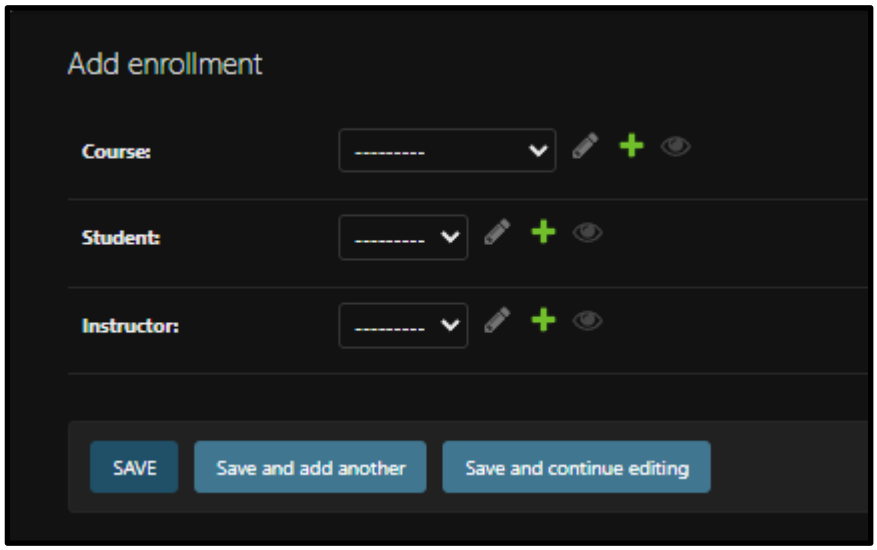


Figure 5.2.27: Add enrollment

In this section based on the figure 5.2.27, the admin can enroll the student according to a certain subject and assign the instructor. Then the name of the instructor will appear in the student dashboard and the name of the student will appear in the instructor dashboard.

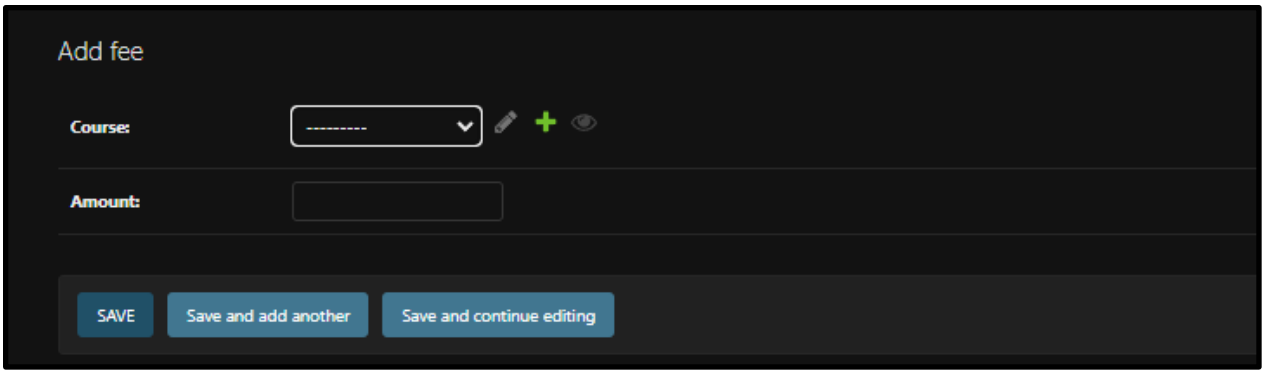


Figure 5.2.28: Add fees

This figure 5.2.28 shows the add fee for available courses, if want to edit or change can perform the adjustment also. In this section, the admin can add the course amount if the fees have not been added during the add course section.

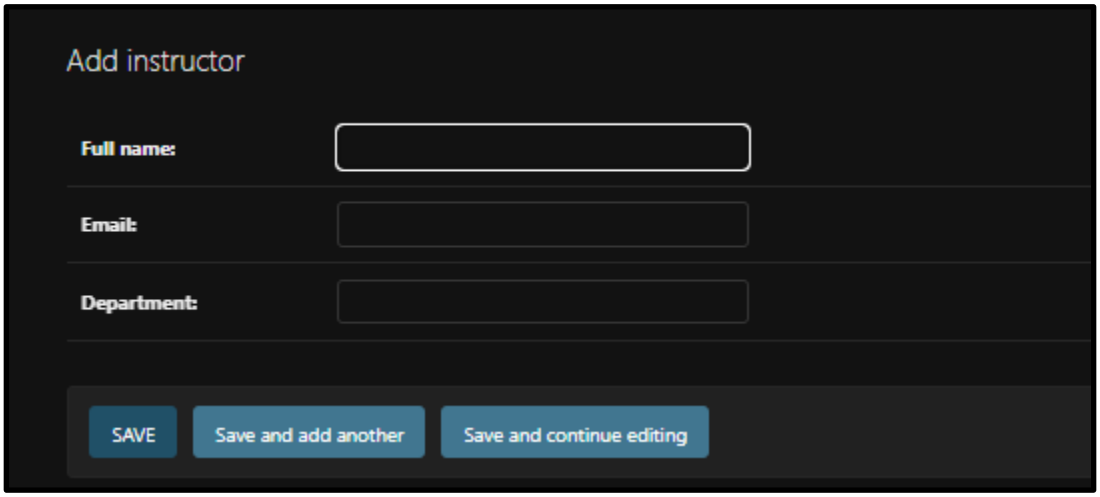


Figure 5.2.29: Add instructors

In this figure 5.2.29, shows the admin is required to enter the instructor name, email with (acad.uni.edu) and the department they work in.

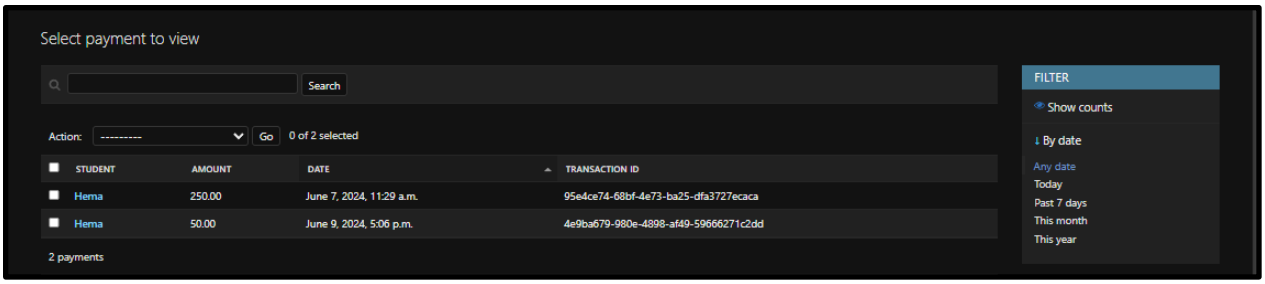


Figure 5.2.30: Payment by the students

The above figure 5.2.30 shows the payment information reflected from the student site whenever the student pays the amount from the student dashboard. This image contains the student's name, amount paid, date and the transaction id.

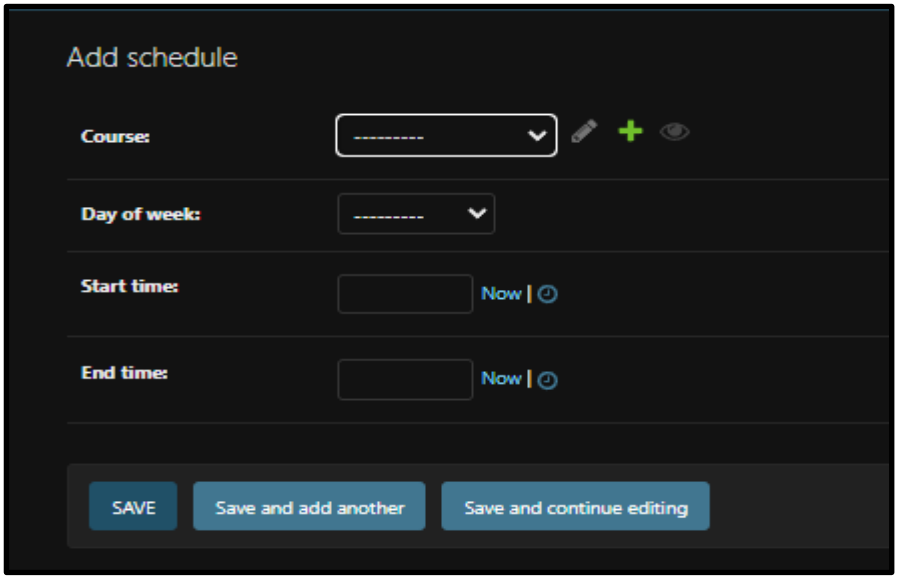


Figure 5.2.31: Add schedule

Based on the figure 5.2.31the admin can adjust the schedule to the available courses only with specification of days of week, start time and end time. For the time the admin are advised to enter the time in (H:M:S)

5.3 System Testing with Users

Table 5.3.1 Participants Information

No	Gender	Age	Ethnicity	Education Level
1	Male	18	Indian	Secondary school
2	Female	20	Indian	Degree
3	Female	23	Chinese	Fresh graduate
4	Male	23	Malay	Degree
5	Female	23	Chinese	Degree

User 1: Vimall

Vimall is a school student but still he felt the system is easy to use as a student. He felt that he can get the necessary information such as fees, instructor email address, notifications from instructor, assignment information and make the payments easily.

User 2: Yuga

Yuga felt that the system is easy to navigate and user friendly to perform the necessary activities such as submitting assignments, easy to find information.

User 3: Chin Pei Wern

Pei Wern felt that in the assignment submitting section can add the link option as well with for student section and instructor section to make easier to submit the assignments.

User 4: Faizaan

Faizaan felt that the system is straightforward, but he suggested me that I could have integrated with other external tools such as Google Drive, Dropbox, or other educational applications which are free to use.

User 5: Tan Shi Huan

Shi Huan felt that the system is easy to use and does have all the necessary functions and features and in terms of the implemented security measures are important solutions for the system to be free from any security faults and vulnerabilities, making it difficult to pass through for the attackers.

5.4 Summary

In the chapter "Testing and Discussion," we show the results of performing several actions by the three main users: Admin, Student, and Instructor. Testing the system ensures that each requirement is met with the functions and features applied in the system. Testing ensures that new data does not corrupt or delete existing records. Apart from understanding the functions and features, it is crucial to know what the Secured Student Information Management System (SIMS) should do. Successful testing and discussion of the system prove that it runs without errors and addresses any debug problems that arise during development. The above discussion on testing the system demonstrates how every feature works accordingly. In conclusion, the Secured Student Information Management System is robust, secure, and effectively supports the flow of the system with everyone's actions.

CHAPTER 6

CONCLUSION

6.1 Overview

In conclusion, successfully implementing the Student Information System will significantly improve the efficiency and effectiveness of managing student-related information within an educational institution. The system streamlined administrative processes, and the accuracy of data, providing timely access to collected information through the system for students, administrators, and academic staff.

6.2 Conclusion

In conclusion, the development of the Secured Student Information Management System marks a significant importance in improving the access and management of student information. This system integrates with some of the features not only the information but such as creating assignments, sending email, submitting assignments, self enrollment and with robust security measures, ensuring that all users as in Admin, Students and the Instructors can interact with the system efficiently and securely.

The key achievement of this system is comprehensive user management for the admins who are controlling the information about every user in one server. Admins have the full authority over user creating, updating and deleting. While performing any new actions the system ensures that these operations do not interfere with existing records or without knowingly the data gets deleted, by maintaining the data integrity securely.

By using this system, the students can effortlessly enroll in courses that are available in the database as a self-enrollment, submit assignments according to the assignment provided by the instructors, and keep track of the sent emails, notifications from instructors, grades and the fees payment as well. This is an enhanced experience for the student for using the system seamlessly.

Apart from the students and admin views, the instructors also can make use of this Secured Student Information Management System. Instructors benefit from the functions that allow them to post announcements, create assignments, mark attendance records, assign the grade for every student and instructors also can send email to students and keep track of the sent email for future references. This improves the communication and education between the instructors and the students.

Additionally, we will look into the security measures that have been applied in the system. RBAC, role-based access control is necessary in this system for students and instructors and the separate URL address for the admin site. The role based access control prevents unauthorized access to resources based on the roles of individual users within the system. This method helps to maintain the integrity and confidentiality of student information. CSRF, cross-site request forgery is another measure which is implemented in the system that ensures that all form submissions are secure and authenticated based on the generated CSRF token.

Moreover, password hashing. In this Secured Student Information Management System to save the entered password, the plaintext is encrypted by using the hashing algorithm PBKDF2 (Password-Based Key Derivation Function2) with a SHA256 and salt which makes the password difficult to be guessed by someone else apart from the user themself. Hashing passwords is a one-way function, which means it cannot be reversed to obtain the original password. Lastly, the time-out session is also another security measure, where it prevents the authorized session from being hijacked by the unauthorized users which is called a session hijacking attack.

The Secured Student Information Management System might stand as a robust, secure and user-friendly platform that significantly efficiently improves the management of the student information. It supports the academic process to be more straightforward and easy to navigate for the users. By integrating strong security measures, the system ensures data CIA, confidentiality, integrity and availability for those who have the valid access to use the system.

6.3 Limitation and Recommendation for Future Works

The current implementation of the Secured Student Information Management System may face scalability issues. This is because this system runs in the SQLite3 database which is lightweight and serverless. This database particularly works for development, testing and for the small to medium size systems. In Django during the project development the SQLite3 is used as the default database. The database is designed to be fast, reliable, and fully self-contained. Since the student information management system deals with a lot of information and data the SQLite3 is not recommended because this database is designed for large number of datasets at the same time if the database handles up to some size, the efficiency of the system performance might degrade everytime an information is stored into and the system does not work seamlessly and effectively.

Therefore, given the scalability issues of SQLite3 in the Secured Student Information Management System, with the dataset might grow in the future, it is recommended to use the type of database that can handle large amount of information such as the robust relational database management system (RDBMS). This is suitable when the system moves to the production state. Updating the database settings in the Django project to use (RDBMS) such as PostgreSQL or MariaDB and performing the migrations to transfer the existing data to the new database. Apart from the suitable database, it is recommended to monitor and maintain the database regularly to decrease any loopholes that can be useful for attackers to make use of it. Implementing a backup strategy helps to prevent data loss in future and use the backup to solve the data corruption which can happen due to software bugs, hardware failures or any other issues which can be unintentional and unexpected. These recommendations for future works not only enhance the reliability but also the security of the Secured Student Information Management System.

Apart from the database settings, the system is limited to certain functions only. To solve or improve the system I would like to integrate with some of the external tools such Google Classroom, Google Meet, Outlook and so on which can be beneficial for all the authorized users

to communicate with each other for specific reasons such as instructor having online classes through Google Meet. Whereas for Google Classroom the instructors for certain subjects can post any homework for the students who are enrolled into the respective courses.

Implementing these recommendations will not only address the current limitations of scalability and functionality but also enhance the overall reliability, security, and user experience of the Secured Student Information Management System. The transition from SQLite3 to a suitable RDBMS along with integration of external tools will equip the system to handle future growth effectively while meeting the needs of its users securely. Regular maintenance and monitoring will further ensure the system's optimal performance and data integrity over time.

REFERENCES

PowerSchool. (2024, January 23). *PowerSchool K-12 Software & Cloud-Based Solutions.* https://www.powerschool.com/

Blackbaud. (2024, January 5). *Student Information System (SIS) Software | BlackBaud*. https://www.blackbaud.com/products/student-information-system

Skyward | A better SIS and ERP experience. (n.d.). https://www.skyward.com/

Aeries SIS - Aeries Software. (n.d.). https://www.aeries.com/solutions/aeries-sis/

Rediker Software Advantages and Products. (n.d.). [Video]. https://www.rediker.com/

Teachmint. (n.d.). *TeachMint : School LMS & ERP | Integrated School Platform (ISP)*. https://www.teachmint.com/en-my

QuickSchools. (n.d.). *School management software - QuickSchools.* https://www.quickschools.com/

Wisenet - a division of Adapt IT. (n.d.). *Student Management system and training applications from Wisenet*. Wisenet - a Division of Adapt IT. https://www.wisenet.co/

Moffitt, P. (2023, September 21). *GradeLink Student Information System: Simplify and Succeed*. Gradelink: Student Information System. https://www.gradelink.com/

Orah: Improve Student Life | Attendance, Wellbeing & Communications. (n.d.). https://www.orah.com/

Sad. (2013, March 3). *Advantages and Disadvantages of SDLC*. Eternal Sunshine of the IS Mind. https://eternalsunshineoftheismind.wordpress.com/2013/03/03/advantages-and-disadvantages-of-sdlc/

20 Best Student Information Systems in 2024. (2023, October 10). *Research.com*. https://research.com/software/best-student-information-systems-in-2022-key-features-of-the-top-student-information-systems#google_vignette

Team, A. (2024, January 19). *The most loved and hated programming languages according to developers | Appetiser*. Appetiser: Web and Mobile App Development Melbourne, Australia. https://appetiser.com.au/blog/the-most-loved-and-hated-programming-languages-according-to-developers/

Sandamal, H. (2021, December 16). Software Development Life Cycle methods - Hansa Sandamal - Medium. *Medium*. https://hansasandamal.medium.com/software-development-life-cycle-methods-7ccd25d6e198

SQLite. (2024, May, 23). What is SQLite https://sqlite.org/

APPENDICES

Appendix A: Meeting Logs

MULTIMEDIA UNIVERSITY

Faculty of Information Science and Technology (FIST)

Final Year Project Meeting Log

MEETING DATE: 4/4/2024	**MEETING NO.: 1**
PROJECT ID: T831084	
PROJECT TITLE : Secured Student Information Management System	
TRIMESTER : Trimester 2 2023/2024	**SUPERVISOR : Ms. Pa Pa Min**
STUDENT ID & Name: 1191101916 & Hemanilashinii A/P Tharmalingam	**CO- SUPERVISOR :**

All to be filled in by student

1. WORK DONE

- Find and learn how does the Python language works
- Get to know how the Django framework is used in the Python

2. WORK TO BE DONE

- Starting to create the system

3. PROBLEMS ENCOUNTERED

- Setting up and installing the Django into the device

4. COMMENTS

Supervisor's Signature & Stamp	Co-Supervisor's Signature & Stamp (if any)	Student's Signature
		thema

NOTES:

1. Items 1 – 3 are to be completed by the students before coming for the meeting. Item 4 is to be completed by the supervisor.
2. For FYP Phase 1, total six log sheets are to be submitted (every other week*).
3. For FYP Phase 2, total six log sheets are to be submitted (every other week**).
4. Log sheets are compulsory assessment criteria for FYP. Student who fails to meet the requirements of log sheets will not be allowed to submit FYP report.

*: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the first trimester (week 11: report submission, weeks 13 & 14: presentation)

**: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the second trimester (week 11: report submission, weeks 13 & 14: presentation)

MULTIMEDIA UNIVERSITY

Faculty of Information Science and Technology (FIST)

Final Year Project Meeting Log

MEETING DATE: 18/4/2024	**MEETING NO.: 2**
PROJECT ID: T831084	
PROJECT TITLE : Secured Student Information Management System	
TRIMESTER : Trimester 2 2023/2024	**SUPERVISOR : Ms. Pa Pa Min**
STUDENT ID & Name: 1191101916 & Hemanilashinii A/P Tharmalingam	**CO- SUPERVISOR :**

All to be filled in by student

1. WORK DONE

- Starting with creating users and saving it to the database
- Creating registration and login page

2. WORK TO BE DONE

- Adding RBAC to the login page

3. PROBLEMS ENCOUNTERED

- Creating database accurately and precisely

4. COMMENTS

thema

Supervisor's Signature & Stamp	Co-Supervisor's Signature & Stamp (if any)	Student's Signature

NOTES:

5. Items 1 – 3 are to be completed by the students before coming for the meeting. Item 4 is to be completed by the supervisor.
6. For FYP Phase 1, total six log sheets are to be submitted (every other week*).
7. For FYP Phase 2, total six log sheets are to be submitted (every other week**).
8. Log sheets are compulsory assessment criteria for FYP. Student who fails to meet the requirements of log sheets will not be allowed to submit FYP report.

*: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the first trimester (week 11: report submission, weeks 13 & 14: presentation)

**: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the second trimester (week 11: report submission, weeks 13 & 14: presentation)

MULTIMEDIA UNIVERSITY

Faculty of Information Science and Technology (FIST)

Final Year Project Meeting Log

MEETING DATE: 2/5/2024	**MEETING NO.: 3**
PROJECT ID: T831084	
PROJECT TITLE: Secured Student Information Management System	
TRIMESTER: Trimester 2 2023/2024	**SUPERVISOR: Ms. Pa Pa Min**
STUDENT ID & Name: 1191101916 & Hemanilashinii A/P Tharmalingam	**CO- SUPERVISOR:**

All to be filled in by student

1. WORK DONE • Implementing the role-based access control into the system
2. WORK TO BE DONE • Creating the features each and every user can access to • Making the features to function
3. PROBLEMS ENCOUNTERED • Accurately RBAC making to work based on the university email. • Recongnising the users based on the emails
4. COMMENTS

thema

Supervisor's Signature & Stamp	Co-Supervisor's Signature & Stamp (if any)	Student's Signature

NOTES:

9. Items 1 – 3 are to be completed by the students before coming for the meeting. Item 4 is to be completed by the supervisor.
10. For FYP Phase 1, total six log sheets are to be submitted (every other week*).
11. For FYP Phase 2, total six log sheets are to be submitted (every other week**).
12. Log sheets are compulsory assessment criteria for FYP. Student who fails to meet the requirements of log sheets will not be allowed to submit FYP report.

*: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the first trimester (week 11: report submission, weeks 13 & 14: presentation)

**: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the second trimester (week 11: report submission, weeks 13 & 14: presentation)

MULTIMEDIA UNIVERSITY

Faculty of Information Science and Technology (FIST)

Final Year Project Meeting Log

MEETING DATE: 23/5/2024	**MEETING NO.: 4**
PROJECT ID: T831084	
PROJECT TITLE: Secured Student Information Management System	
TRIMESTER: Trimester 2 2023/2024	**SUPERVISOR: Ms. Pa Pa Min**
STUDENT ID & Name: 1191101916 & Hemanilashinii A/P Tharmalingam	**CO- SUPERVISOR:**

All to be filled in by student

1. WORK DONE

- Implementing the role-based access control into the system

2. WORK TO BE DONE

- Implementing the SSL certificate to the system
- Creating the front-end languages

3. PROBLEMS ENCOUNTERED

- Integrating the front-end with Python

4. COMMENTS

Supervisor's Signature & Stamp	Co-Supervisor's Signature & Stamp (if any)	Student's Signature
		thema

NOTES:

13. Items 1 – 3 are to be completed by the students before coming for the meeting. Item 4 is to be completed by the supervisor.
14. For FYP Phase 1, total six log sheets are to be submitted (every other week*).
15. For FYP Phase 2, total six log sheets are to be submitted (every other week**).
16. Log sheets are compulsory assessment criteria for FYP. Student who fails to meet the requirements of log sheets will not be allowed to submit FYP report.

*: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the first trimester (week 11: report submission, weeks 13 & 14: presentation)

**: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the second trimester (week 11: report submission, weeks 13 & 14: presentation)

MULTIMEDIA UNIVERSITY

Faculty of Information Science and Technology (FIST)

Final Year Project Meeting Log

MEETING DATE: 30/5/2024	**MEETING NO.: 5**
PROJECT ID: T831084	
PROJECT TITLE: Secured Student Information Management System	
TRIMESTER: Trimester 2 2023/2024	**SUPERVISOR: Ms. Pa Pa Min**
STUDENT ID & Name: 1191101916 & Hemanilashinii A/P Tharmalingam	**CO- SUPERVISOR:**

All to be filled in by student

1. WORK DONE • Done Implementing SSL
2. WORK TO BE DONE • Creating the front-end languages
3. PROBLEMS ENCOUNTERED • Integrating the front-end with Python
4. COMMENTS

Supervisor's Signature & Stamp	Co-Supervisor's Signature & Stamp (if any)	Student's Signature
		thema

NOTES:

17. Items 1 – 3 are to be completed by the students before coming for the meeting. Item 4 is to be completed by the supervisor.
18. For FYP Phase 1, total six log sheets are to be submitted (every other week*).
19. For FYP Phase 2, total six log sheets are to be submitted (every other week**).
20. Log sheets are compulsory assessment criteria for FYP. Student who fails to meet the requirements of log sheets will not be allowed to submit FYP report.

*: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the first trimester (week 11: report submission, weeks 13 & 14: presentation)

**: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the second trimester (week 11: report submission, weeks 13 & 14: presentation)

MULTIMEDIA UNIVERSITY

Faculty of Information Science and Technology (FIST)

Final Year Project Meeting Log

MEETING DATE: 6/6/2024	**MEETING NO.: 6**
PROJECT ID: T831084	
PROJECT TITLE: Secured Student Information Management System	
TRIMESTER: Trimester 2 2023/2024	**SUPERVISOR: Ms. Pa Pa Min**
STUDENT ID & Name: 1191101916 & Hemanilashinii A/P Tharmalingam	**CO- SUPERVISOR:**

All to be filled in by student

1. WORK DONE • Done integrating front-end with Python
2. WORK TO BE DONE • Implementing the SSL certificate to the system • Creating the front-end languages
3. PROBLEMS ENCOUNTERED • Making the system from HTTP to HTTPS
4. COMMENTS

thema

Supervisor's Signature & Stamp | Co-Supervisor's Signature & Stamp (if any) | Student's Signature

NOTES:

21. Items 1 – 3 are to be completed by the students before coming for the meeting. Item 4 is to be completed by the supervisor.
22. For FYP Phase 1, total six log sheets are to be submitted (every other week*).
23. For FYP Phase 2, total six log sheets are to be submitted (every other week**).
24. Log sheets are compulsory assessment criteria for FYP. Student who fails to meet the requirements of log sheets will not be allowed to submit FYP report.

*: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the first trimester (week 11: report submission, weeks 13 & 14: presentation)

**: week 1, 3, 5, 7, 9, 11 or 2, 4, 6, 8, 10 of the second trimester (week 11: report submission, weeks 13 & 14: presentation)