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The Implementation of Course Timetable Organizer in UTHM

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Abstract

UTHM Course Timetable Organizer is a web-based timetable system for University Tun Hussein Onn to present information regarding timetable. The purpose of developing this system is to overcome the course conflict issues and optimize the process of timetable generation. This system had solved those issues by having timetable making module which any course conflict will cause warning to alert user. This system is also connected with database which the data can be saved. The different authorization level of user such as staff, lecturer and student helps to access difference needed modules. For staff who also the admin, section allocation module prepared to assign section for faculty course in a more systematical way instead of passing word by stage from staff to lecturer to student. While, student timetable checking module helps lecturer to monitor correctness of timetable for student under advising. Meanwhile, the system also provide history timetable module for student side to check previously generated timetable. This project is implemented waterfall methodology and developed using Hypertext Markup Language (HTML), Hypertext Preprocessor (PHP), JavaScript (JS), and Cascading Style Sheets (CSS) in Visual Studio Code. This course timetable organizer system is expected to help UTHM students to able generate their own timetable errorless

1. Introduction

Course Timetable management has become a crucial task in nowadays fast-paced academic environment [1]. An effective course timetable organizer system is essential given the challenges of managing the timeslot of several courses, maintaining optimal classroom utilization, and organize the lecturers' teaching slot for each section of courses [2]. There is an idea to create an elaborate and user-friendly course timetable organizer system. By this system, its aim to automate and optimize the process of timetable creation, maximizing resource allocation, minimize conflicts and enhance the overall scheduling experience. The system also seeks to provide new level of authorization to differentiate between user which includes lecturers and students. This can ease the progress of adding new functionality for both user in system with different requirement needed by users.

In UTHM, some students had discover that the existing course timetable system which is the timetable plus is functional shortage. The timetable for each course is separate by general course and faculty course which handle by different staff from each of department. Therefore, the probability of having course conflict is higher. This may affects the choices of section for students in managing their timetable. Other than that, the existing system is also not having a functionality to create own timetable. This causes students need to manually creating their own timetable with other application or tool. By manually creating own timetable, students may wrongly refer the course timeslot or section provided. This progress need to repeat 6 to 7 times since student need to register that amount of course for each semester. In addition, the existing system includes incompatible

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information. This can lead to confusing user to use it, especially for the first time user. It had contain incompatible information as courses that provided in different campus, and different years. The miss choose of the wrong courses may lead to a bigger problem which is to change section, that may cause course conflict.

Hence, an enhance Course Timetable Organizer System is required to address the problem that mentioned above. It can benefits for each user of the system including student, lecturer, and administrator to reduce their work load and minimize error occurs. The system intends to provide a supportive learning environment by promoting transparency, accessibility, and adaptability in the administration of course schedules through the implementation of user-centric design principles and rigorous testing.

The first objective of this study is to design a Course Timetable Organizer System to enhance the timetable system that meet user requirement. Secondly is to develop a Course Timetable Organizer System for FSKTM, UTHM. Thirdly is to perform user testing for the developed Course Timetable Organizer System to the target user.

This project involved 3 main users from UTHM, which are the university staff as administrator, while lecturer and student as user. There are total eight modules provided in the proposed system, which are login module, user management module, course management module, section allocation module, timetable generating module, history timetable checking module, general timetable checking module, student timetable checking module. All user manage to login into the system using specific id and password. Administrator able to add, edit and delete user in the system. Administrator also able to add, edit, and delete course information in the system. In section allocation module, administrator can assign suggested section for lecturer. For student, student able to generating own timetable in this proposed system. Student able to check history timetable from past semester. Student and lecturer able to check general timetable that includes timeslot for each courses. While, lecturer able to view timetable for students under advice to ensure every student have a timetable planning. Lecturer also able to view general course timetable, which updated by admin.

In the following section, Section 2 discusses the related work of the UTHM course timetable organizer system and the study of existing UTHM timetable system and study of existing related systems. Next, Section 3 explains the methodology applied in this system and the system analysis and design of proposed system. Then, Section 4 explore the results and outputs of the proposed system. Finally, a short conclusion on current works and the future recommendation in the proposed system are concludes in Section 5.

2. Related Work

2.1 Course Timetable Organizer System

According to Cambridge Dictionary, course give the meaning as a specific subject that contains a study plan or collection of classes which having an exam or certification. The action of timetable comes to timetabling that defines as time planning for a group of work that already success done or in the progress or a time allocation for a progress of certain work that contains several parts [3]. "*Organizing is the process of defining and grouping the activities of the enterprise and establishing the authority relationships among them.*" [4] While organizer is the person or system that arranges it. However, the term system can be defined as a connection between a groups of interacting entities or item [5]. Therefore, course timetable organizer system is a connection between groups of work to produce a study plan schedule for students. The aims of a course timetable organizer system is to solve university course timetabling problem (UCTTP), which needs a tools to assign overall items in term of timeslots and rooms by all restriction are well-pleased [6].

2.2 Study of existing timetable system in UTHM

The current existing timetable system that used in UTHM is using a web-based system that provided by timetable plus class as template. It consists a main page that able user to undergo several module includes UTHM master timetable, course timetable, room timetable, batch timetable, lecturer timetable and a login module for dean, Head of Program (HOP), Head of Department (HOD), and manager. The UTHM master timetable module which contain the general timetable for every faculty that display the course timetable by clarify the usage of room and specific timeslot. The use of this module begin with selecting faculty, building and day, it will able to display all course which satisfy all the condition. It also consist a filtering function to specify room selected and a print function to print out the timetable. Other than that, Course timetable module that includes the timetable according courses. The output will be presented in term of schedule and class list. The compulsory item that need to be select before view the timetable are the program that the course performed and the specific course. It able to specify the class type whether lecturer session or lab session and the group section,

to search in more accurate. Room timetable module displays timetable after selecting the building and the room located, while, the batch timetable module which shows timetable after selecting the faculty and current batch. Moreover, the lecturer timetable module that show timetable after selecting the faculty and specific lecturer. Lastly, the login module for dean, HOP, HOD, and manager by entering respectively ID as username and password to login to admin side page.

2.3 Study of existing related system

There are two timetable system studied from others Malaysia local university to carry up the study of existing timetable system which are timetable system in University of Technology Malaysia (UTM) and University Technology MARA (UiTM). The advantages and disadvantages of these system will be analyzed to implement a functional fulfil system that take those advantages as ideal model and enhance the disadvantages to ensure proposed system is fully designed in term of functionality and usability

In general, timetable system that now used in University of Technology Malaysia (UTM) to deliver to the primary user, student is based on Microsoft Excel. The staff will arrange the time slot for every course and edit in a excel file based on faculty. As the content in the excel file, it will contain the course code, course name, programmed taken, estimated register, section, room, and time for specific course. The excel file will distributed to student by academic advisor after the finalized timeslot is fixed. After that, students needs to make manually their timetable according the timeslot of course as shown in the excel file provided. Although that the system is created without or minimize technology usage, but the timeslot for each courses is well design that lead to less last minute changes are happen while using this system. The advantages for this system is that the system did not require internet access after download the excel file. However, it bring disadvantages such as staff needs more effort to present a well-designed timetable.

Furthermore, in UTM, it also provides a web-based system for the faculty of Malaysia-Japan International Institute of Technology (MIJIT). This web-based system is named as “Intelligent Timetable” that specific used for MIJIT student. In this system, it contains room timetable, student timetable by batch, lecturer timetable, clash checker and listing that show the long list for each module. For room timetable, user able to check and view the timeslot for usage of each room. Moreover, student timetable which able user to check batch timetable by selecting by batch. Other than that, the lecturer timetable shows the timetable for each lecturers that teach in faculty of MIJIT. Subject timetable and clash check module able user to make their own timetable and check for course conflict. While course conflict happens, an alert message will display on the windows and unable to add specific course in users’ timetable. Lastly, the listing module displays all the information in a long list by module. The advantages of this system is it provides detail timetable information for section as room, student, and lecturer. It also provides timetable generate tool with clash checker that ease student to plan the timetable. In contrast, it lack of function of checking course timetable which unable to view timeslot for different section.

In UiTM, the existing course timetable system is web-based system that divided into two system used which are the UiTM Class Timetable system and UiTM Timetable Generator system. These two system provides different functionality in order to help ease student while preparing timetable. UiTM Class Timetable system provide functionality of checking course timetable. User need to select any campus of UiTM from more than 30 campuses around Malaysia. The needs to select a faculty if main campus Selangor in chosen. User optional search with course code to view the timetable for the specific course, while empty the course code textbox will able to view all courses provided in specific campus. In the course checking timetable, it provides information of timeslot, group section, mode of study, status, room, and faculty that this course provided. The UiTM Timetable Generator, it provides functionality of timetable generate module. User compulsory to select the campus and optional to select the faculty from list given. User are also allow to import excel file into the system as reference. The insertion of course and group section will automatically add into timetable.

Table 1 *Comparison between existing system and proposed system*

Feature / System	UTM	UTM (MIJIT)	UiTM	UTHM	Proposed System
Login Module for Admin	×	×	×	✓	✓
Login Module for Lecturer	×	×	×	×	✓
Login Module for User	×	×	×	×	✓
User Management Module	×	×	×	×	✓
Course Management Module	✓	✓	×	✓	✓

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Section Allocation Module	×	×	×	×	✓
Course Timetable Module	✓	×	✓	✓	✓
Batch Timetable Module	×	✓	×	✓	×
Room Timetable Module	×	✓	×	✓	×
Lecturer Timetable Module	×	✓	×	✓	×
Student Timetable Checking Module	×	×	×	×	✓
Timetable Generate Module	×	✓	✓	×	✓
History Timetable Checking Module	×	×	×	×	✓
System Type	Excel file	Web-based	Web-based	Web-based	Web-based

* ✓ means system includes specific module
** × means system did not includes specifics module

3. Methodology/Framework

The Waterfall Model was chosen as the methodology used to complete developed the system. Waterfall Model is a sequential software development methodology that follows a linear and cascading approach to project management. Waterfall model was known as a traditional Software Development Lifecycle (SDLC) which introduced by Winston Royce in 1970 [7]. This methodology was chosen based on several factors such as clear requirement needed, ease documentation process, project size and the project flow. In this project, the requirement of this system is clear stated and fixed, which it will not having append requirement Furthermore, it complements projects where a comprehensive plan can be drawn up early and provides an overall roadmap for development, through its structured and sequential approach. This model's rigidity is an asset in this project where a fixed scope and a predefined set of functionalities are definite, allowing for accurate estimation of timelines.

3.1 Planning Phase

The planning phase is the beginning of the system development process, involving the identification and understanding of problem in existing system, project objectives, and scope. During the planning phase, critical activities involve defining the functional and non-functional requirements. Activities follows with providing a detail timeline of the project that listed out the expectation duration and activities that carried out by develops a Gantt chart. The Gantt chart is attached in Appendix A.

Table 2 *Functional requirements*

No.	Module	Functionalities
1.	Login Module	The system manages the user login allowance by using id and password. The system shows alert message for invalid input. The system access to dashboard for each level of authorisation of user after successful login.
2.	User Management Module	The system allows administrator to create new users. The system allows administrator to edit user details. The system allows administrator to delete users. The system allows administrator to change user status.
3.	Course Management Module	The system allows administrator to create new courses. The system allows administrator to edit course details. The system allows administrator to delete courses.
4.	Section Allocate Module	The system allows administrator to assign section for PAK based on courses. The system allows administrator to change section for PAK based on courses.
5.	Timetable Generate Module	The system allows student to produce own course timetable.
6.	History Timetable Checking	The system allows student to check past semester timetable.

	Module	
7.	Timetable Checking Module	The system allows student and lecturer to check timeslot for each courses. The system allows student to view their own generate timetable. The system allows lecturer to view students' timetable under their advice.

Table 3 *Non-Functional requirements*

No.	Module	Functionalities
1.	Performance	Response time for each action below 1 second. Scalability for accommodate future growth. High throughput to able process plenty data in short period.
2.	Operational	Reliability to reduce failure occur. Maintainability for ease of updates and maintained. Compatibility with any browser.
3.	Security	Can only access after login with valid id and password. Data protection to prevent user information leak.

3.2 Analysis Phase

In the analysis phase, analyst engage in activities such as problem definition, requirement gathering, understanding dataflow, feasibility studies. While system design aims to transform those identified requirement into a detailed and tangible plan, ensuring the system is scalable, maintainable, and aligned with the specified requirements. The output of this phase is providing Flowchart, Data Flow Diagram (DFD), and Entity Relationship Diagram (ERD).

3.2.1 Flowchart

The flowchart illustrates the workflow of each kind of user for the proposed system. The flowchart for administrator, lecturer and student are represented in Appendix B, Appendix C and Appendix D respectively.

3.2.2 Data Flow Diagram (DFD)

Context diagram is a high-level visual representation that provides an overview of a system and its interactions with external entities, also known as level 0 DFD, which primary focuses on the external entities that interact with the system rather than the internal details of system itself. More details of Level 1 DVD can refer to Appendix E.

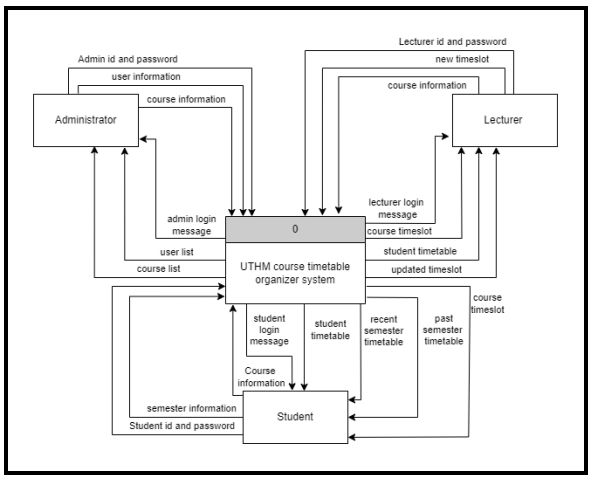

Figure 1: DFD Context Diagram for UTHM course timetable organizer system

3.2.3 Entity Relationship Diagram (ERD)

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An Entity-Relationship Diagram (ERD) is a visual representation that illustrates the entities within a system or database and the relationships between them. In the creation of database structures, this graphic tool is often used to represent objects as rectangles and relationships as lines in connection with these rectangles. Relationships, depicted by lines connecting entities, reveal how these entities are associated, whether through one-to-one, one-to-many, or many-to-many connections.

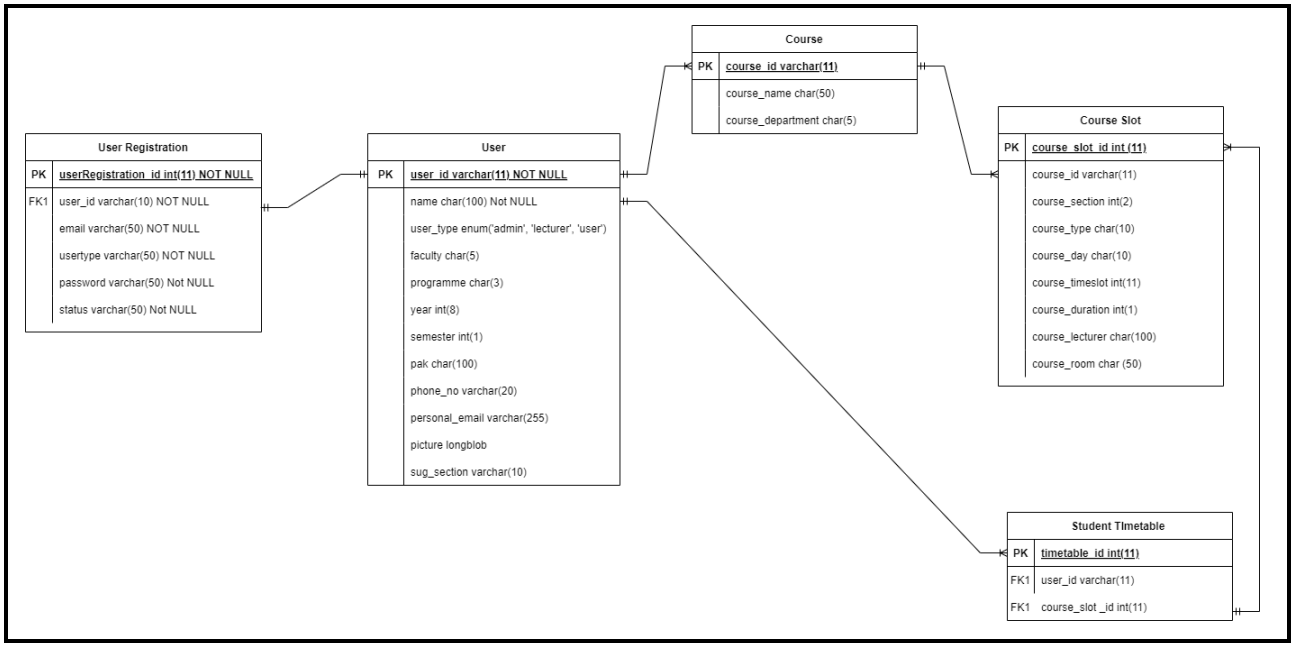

Figure 2: ERD for UTHM course timetable organizer system

3.3 Design Phase

Design derived from the analysis of requirements, is translated into a concrete blueprint. Design involves making critical decisions about system architecture, component interactions, data structures, and user interfaces to ensure the envisioned solution aligns with the specified requirements.

3.3.1 Interface Design

This section discusses the user interface design of the proposed system for each functional module in UTHM course timetable organizer system. The interface is designed using draw.io software. Figure 3 shows the login interface of proposed system. The login interface is main page of the UTHM course timetable organizer system before launching other functional modules. Further GUI design refer to Appendix F.

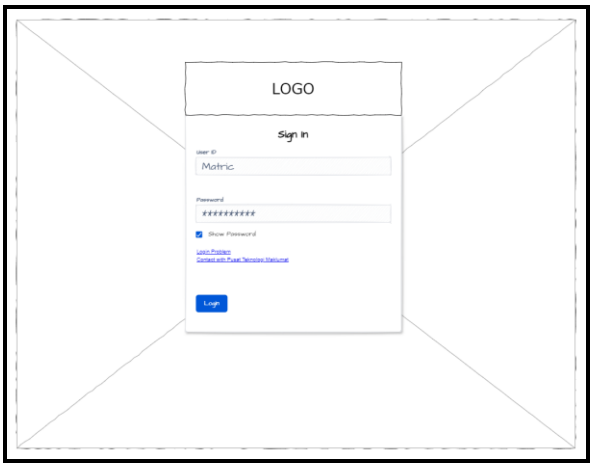

Figure 3: Login Interface

3.4 Implementation Phase

In the implementation phase, the actual coding of the software system takes place based on the design specifications. Therefore, the major purpose of this phase is to code out the system based on the blueprint from design phase. Developers follow coding standards, best practices, and the design documentation to translate the conceptualized system into executable code. The collaborative effort of developers and adherence to the design plan are crucial for a successful implementation. During the implementation phase, the primary activity in this phase is coding, where developers write code based on the design specifications. Each of the module implemented are fully functional, apply user interface (UI) and user experience (UX) design and connected with database. The tools used in this implementation phase for coding usage is Visual Studio Code.

The UTHM Course Timetable Organizer System is developed by using Visual Studio Code application. The proposed system utilizes HTML, CSS, JavaScript, PHP and MySQL. The interfaces of this system consist of several module including login module, user management module, course management module, section Allocation module, Course timetable checking module, student timetable checking module, timetable generating module, and History timetable module.

3.4.1 Login Module

Login Module is a critical component of a system that manages user authentication and access control. Users prompt to enter the User ID and Password, and system will verifying these credentials against a stored database of authorized users. The module grants access to the system's resources and features according to the user's permissions and roles. Figure 4 shows the Login Module interface for UTHM Course Timetable Organizer. Figure 5 shows the error message shown when incorrect User ID or Password entered in the system. The system will display "Wrong user ID & password combination".

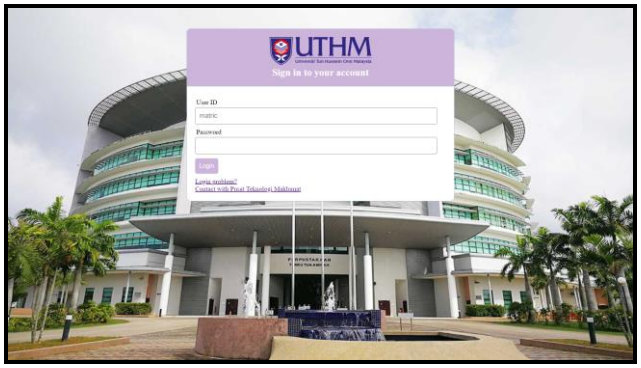

Figure 4: Login Module Interface

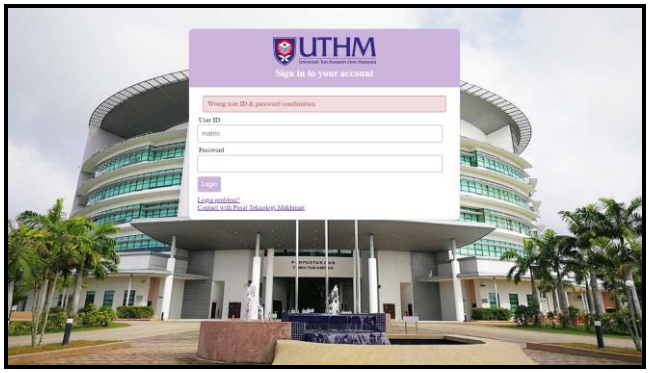

Figure 5: Error Message when Incorrect User ID or Password entered

Figure 6 shows the partial code for validation check of User ID and Password in the system. The code also check for user access control to prompt user to respective interface based on user type.

```
// attempt login if no errors on form
if (count($errors) == 0) {
    $password = md5($password);
    $query = "SELECT * FROM userregistration WHERE user_id='$user_id' AND
    password='$password' LIMIT 1";
    $results = mysqli_query($db, $query);

    if (mysqli_num_rows($results) == 1) { // user found
        // check if user is admin or user
        $logged_in_user = mysqli_fetch_assoc($results);

        if ($logged_in_user['user_type'] == 'admin') {
            $_SESSION["user"] = $logged_in_user;
            $_SESSION['success'] = "You are now logged in";
            header('location: home.php');
        }
        elseif ($logged_in_user['user_type'] == 'lecturer') {
            $_SESSION['user'] = $logged_in_user;
            $_SESSION['success'] = "You are now logged in";
            header('location: lec_home.php');
        }
        else{
            $_SESSION['user'] = $logged_in_user;
            $_SESSION['success'] = "You are now logged in";
            header('location: index.php');
        }
    }
    else {
        array_push($errors, "Wrong user ID & password combination");
    }
}
```

Figure 6: Partial code for validation check of User ID and Password

3.4.2 User Management Module

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User Management Module is a component to handle the creation, reading, updating, and deletion of user within the system. This module facilitates the administration to add new users, view and modify existing user details, and remove user as necessary. Figure 7 displays the interface of User Management Module. A list of user includes admin, lecturer and student are displayed. Figure 8 shows the create user page after clicking the "Create User" link. This module differentiate into 2 part which are Create User by input user basic information as User ID, and Name. Each user type requires different information needed. In the second part which are the Create User Email, this part used to create user authentication by input User ID, Email, User type, Password, Confirm Password and status.

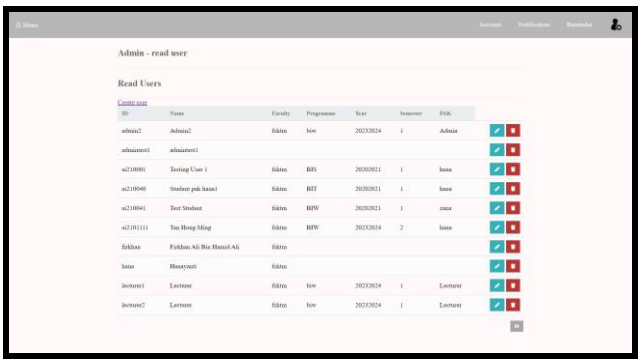

Figure 7: User Management Module Interface

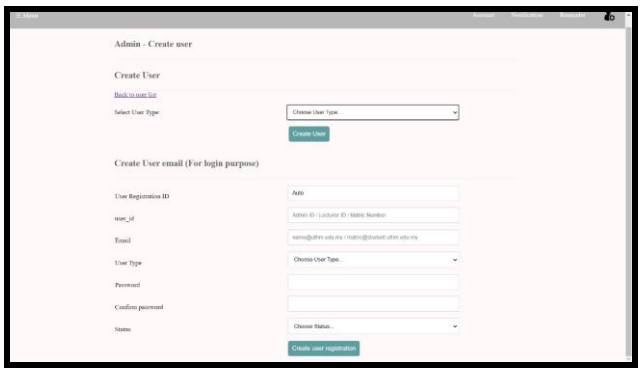

Figure 8: User Management Module Interface in Create User.

3.4.3 Course Management Module

Course Management Module is a component to handle the creation, reading, updating, and deletion of courses related information within the system. This module allows the administration to efficiency add new course slot, view and modify existing course details, and remove of outdated or unnecessary courses slot. Figure 8 displays the interface of Course Management Module. A list of courses with different section are displayed. Figure 9 shows the create course page after clicking the "Create Course" button. This module differentiate into 2 part which are Create Course by input the course ID, course name and course department to record the course offered. In the second part which are the Create Course Slot, this part used to create course slot for each section for specific courses by selecting a specific course and entering the section, course type, course day, course timeslot, course duration, course lecturer, and course room.

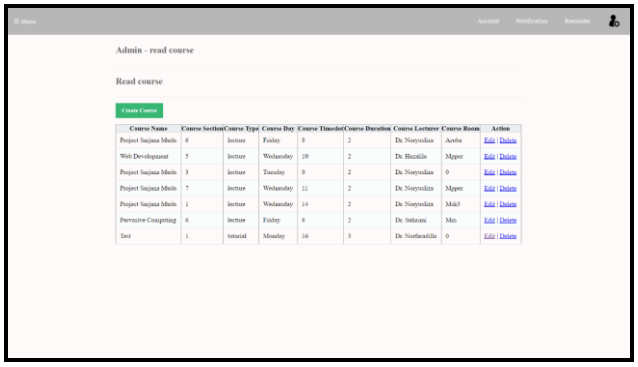

Figure 8: Course Management Module Interface

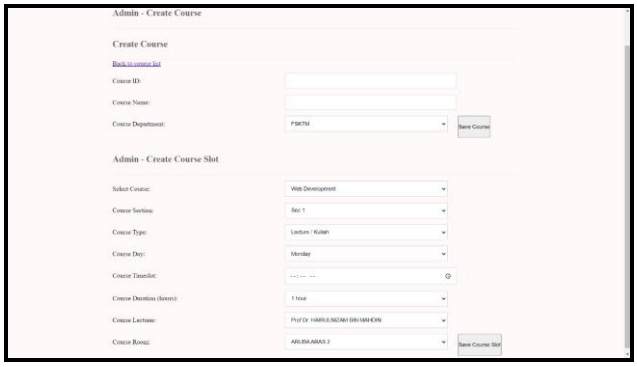

Figure 9: Course Management Module Interface in Create course

3.4.4 Section Allocation Module

Section Allocation Module is a component to facilitate the allocation of sections for faculty courses. This module allows the administration easily allocate suggested section of faculty course to each PAK. Figure 10 displays the interface of Section Allocation Module. A list of name for PAK and a dropdown list for section suggestion purpose displayed. Figure 11 shows the partial code for Section Allocation Module. The code used to display list of lecturer from user list and a dropdown list for section suggestion.

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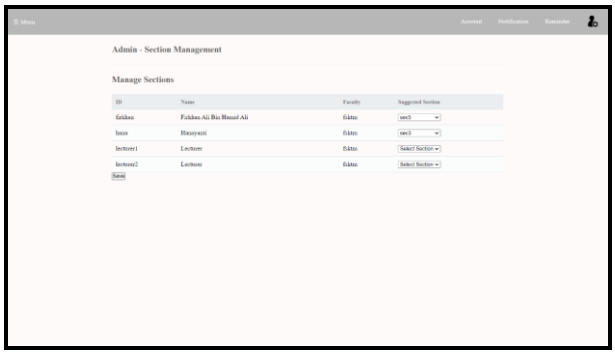

Figure 10: User Management Module Interface

Figure 11: User Management Module Interface

3.4.5 Course Timetable Checking Module

Course Timetable Checking Module is a component to provide users with a comprehensive view of course timetable. This module allows user to select a specific course, system will display all timeslots associated with that course in a timetable format. Figure 12 displays the interface of Course Timetable Checking Module. A course timetable with several timeslot for different section and course type displayed.

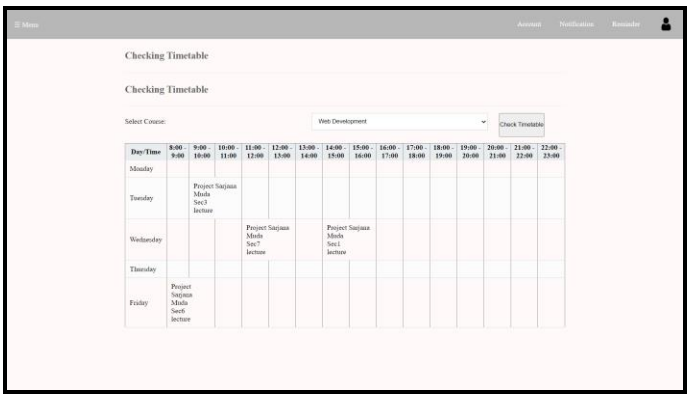

Figure 12: Course Timetable Checking Module Interface

3.4.6 Student Timetable Checking Module

Student Timetable Checking Module is a component to provide a convenient interface for lecturer to access student information and timetable. This module allows lecturer to view the list of students under their PAK and a “view” button to view student information and generated timetable. Figure 13 displays the interface of Student Timetable Checking Module. A list of name for student under advice and a view button to check specific student information displayed.

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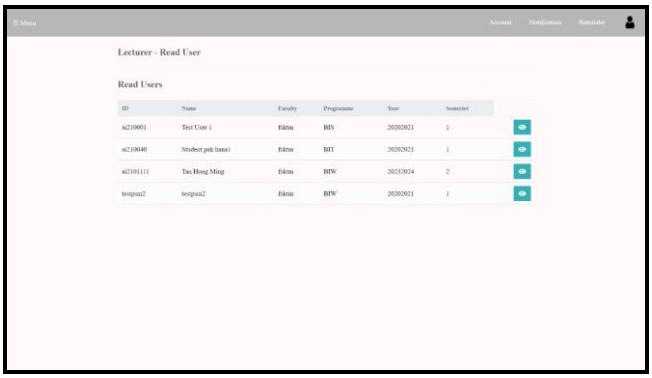

Figure 13: Student Timetable Checking Module Interface

Figure 14 shows the student information page after clicking the "View" button. This module differentiate into 3 part which are Personal Detail by display student's picture, user ID, name, phone No., and personal email. In the second part which are the Academic Detail, this part used to show student's academic information included faculty, programme, year start, and PAK. In the third part, it display the student timetable which generated by student themselves.

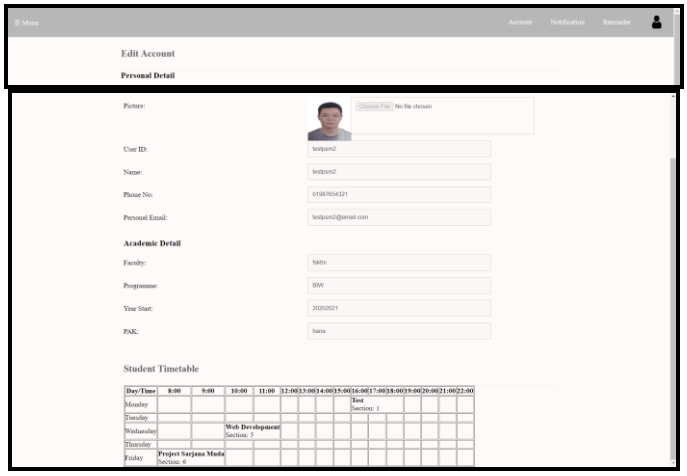

Figure 14: Student Timetable Checking Module Interface – View Student

3.4.7 Timetable Generating Module

Timetable Generating Module is a component streamlines the process of creating and managing course schedules within a system. This module allows user to generate personal timetable after selecting courses and section, with option of add more courses if needed. Figure 15 displays the interface of Timetable Generating Module. A timetable generated based on selected courses and section.

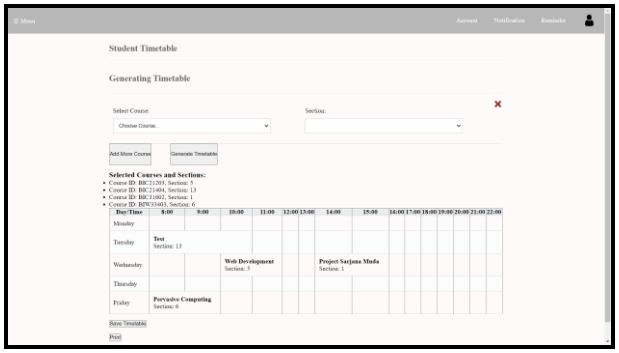

Figure 15: Timetable Generating Module Interface

3.4.8 History Timetable Module

History Timetable Module is a component provided user to view saved timetables stored in the database. This module allows user to view previously saved timetable. Figure 5.19 displays the interface of History Timetable Module. A saved timetable displayed with respective course slot.

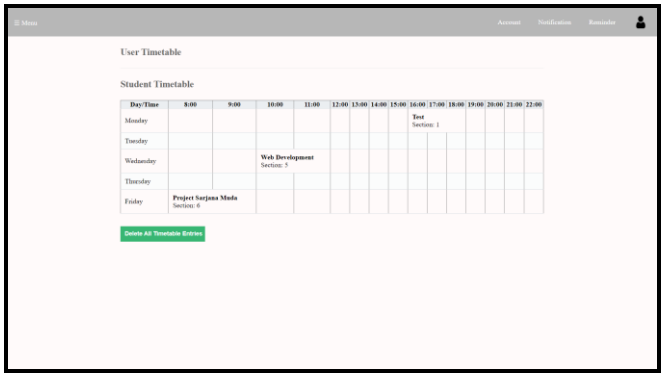

Figure 16: History Timetable Module Interface

3.5 Testing Phase

Testing phase is a pivotal phase within the SDLC, dedicated to the systematic examination of a software product's functionality and performance. The overarching objective of testing is the identification and rectification of inconsistencies or errors, ensuring that the software aligns precisely with its specified requirements. The effectiveness of testing contributes significantly to software's overall quality, reliability and success; thereby promoting the delivery of a product that not only meets but may exceed user expectations. In the testing phase, various testing activities are employed, including unit testing for individual components, integration testing for module interactions, system testing for holistic assessments, and user acceptance testing to gauge user satisfaction. The output of this phase directly decide the successfulness of this project.

Testing phases examined every modules and action in the system to ensure the system operated based on the system requirements. Test case table is a method used to review testing done for the system.

3.5.1 Test Cases

The testing process focus on main functionality of developed system. Table 4 displayed the list of test cases in UTHM Course Timetable Organizer.

Table 4 Test Cases

No.	Test Cases	Description	Status
		Login Module (TEST_100)	
1.	TEST_100_001	Able to login to system by entering correct username and password.	PASS
2.	TEST_100_002	Unable to login to system and Error message shown when entering incorrect username or password.	PASS
		User Management Module (TEST_200)	
3.	TEST_200_001	Able to create new user by entering given information	PASS
4.	TEST_200_002	Able to create user email for login purpose	PASS
5.	TEST_200_003	Able to edit specific user information	PASS
6.	TEST_200_004	Able to delete user and Confirmation message shown	PASS
7.	TEST_200_005	Able to view all user basic information	PASS
		Course Management Module (TEST_300)	
8.	TEST_300_001	Able to create new course by entering given information	PASS
9.	TEST_300_002	Able to create course slot for specific section of courses	PASS
10.	TEST_300_003	Able to edit specific course slot information	PASS

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11.	TEST_300_004	Able to delete course slot and Confirmation message shown	PASS
12.	TEST_300_005	Able to view all course basic information	PASS
		Section Allocation Module (TEST_400)	
13.	TEST_400_001	Able to assign suggested section for lecturer by selecting from option in dropdown list	PASS
14.	TEST_400_002	Able to edit suggested section for lecturer by selecting other option from dropdown list	PASS
		Course Timetable Checking Module (TEST_500)	
15.	TEST_500_001	Able to display course slot for each section of specific courses in timetable form	PASS
		Student Timetable Checking Module(TEST_600)	
16.	TEST_600_001	Able to view basic information and timetable of student under PAK	PASS
		Timetable Generating Module (TEST_700)	
17.	TEST_700_001	Able to select courses and section from dropdown list	PASS
18.	TEST_700_002	Able to add more courses for timetable generation purpose	PASS
19.	TEST_700_003	Able to display generated timetable from selected courses and section	PASS
20.	TEST_700_004	Able to print or save as pdf the generated timetable	PASS
21.	TEST_700_005	Able to save generated timetable to database	PASS
		History Timetable Module(TEST_800)	
22.	TEST_800_001	Able to view saved timetable	PASS
23.	TEST_800_002	Able to delete saved timetable and Confirmation message shown	PASS

3.5.2 User Acceptance Testing

User Acceptance Testing is used to evaluate the system's functionality to ensure it meets their requirements and expectation before deployment. This testing is distribute into 4 part which are Section A, Section B, Section C, and Section D. Section A focused on satisfaction on overall system, while Section B focused on satisfaction of functionality in student side, whereas Section C focused on satisfaction of functionality in lecturer side, meanwhile Section D focused on satisfaction of functionality in administrator side.

3.5.2.1 Section A

In Section A, there are 5 questions asked towards the testers. Figure 17 displays the user acceptance testing result on how easy is the system to use. Among 30 testers, 20 testers (66.7%) think the system is very easy to use while 10 testers (33.3%) think the system is easy to use. Figure 18 displays the user acceptance testing result on how do you rate the design and layout of the system interface. Among 30 testers, 13 testers (43.3%) think the system interface is excellent while 11 testers (36.7%) think the system interface is good whereas 6 testers (20%) think the system interface is neutral.

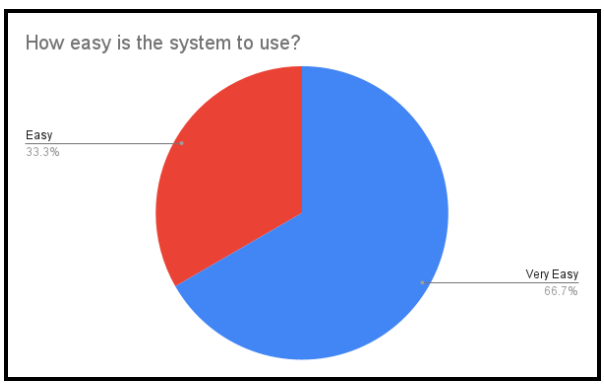

Figure 17: How easy is the system to use.

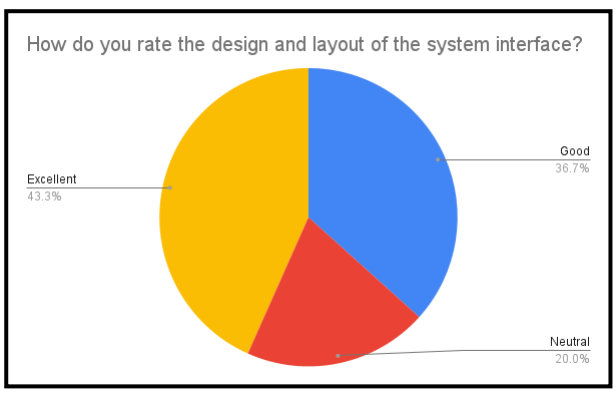

Figure 18: How do you rate the design and layout of the system interface

Figure 19 displays the user acceptance testing result on how often do you encounter bugs or crashes. Among 30 testers, 20 testers (66.7%) never encounter bugs or crashes while 10 testers (33.3%) rarely encounter bugs or crashes. Figure 20 displays the user acceptance testing result on how helpful do you find the system in organizing and managing your timetable. Among 30 testers, 23 testers (76.7%) feel the system very helpful while 7 testers (23.3%) feel the system is helpful.

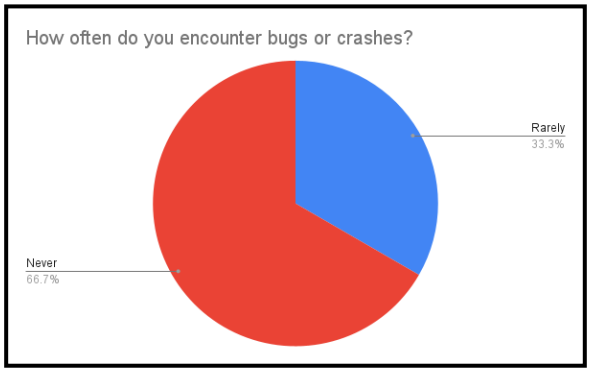

Figure 19: how often do you encounter bugs or crashes

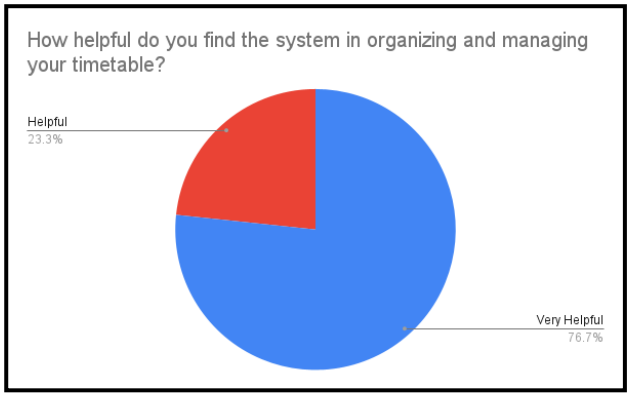

Figure 20: how helpful do you find the system in organizing and managing your timetable

Figure 21 displays the user acceptance testing result on how satisfied are you with the system in overall. Among 30 testers, 22 testers (73.3%) very satisfy with the system while 8 testers (26.7%) satisfy with the system.

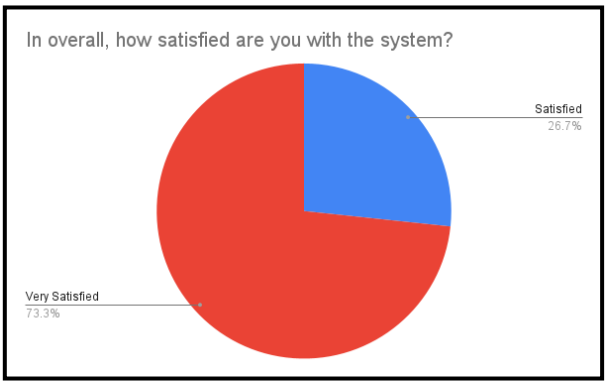

Figure 21: how satisfied are you with the system in overall

3.5.2.2 Section B

In Section B, there are 3 questions asked towards the testers. Figure 22 displays the user acceptance testing result on satisfaction with the Course Timetable Checking Module. Among 30 testers, 16 testers (53.3%) very satisfied with Course Timetable Checking Module while 14 testers (46.7%) satisfied with it. Figure 23 displays the user acceptance testing result on satisfaction with the Timetable Generating Module. Among 30 testers, 26 testers (86.7%) very satisfied with Timetable Generating Module while 4 testers (13.3%) satisfied with it.

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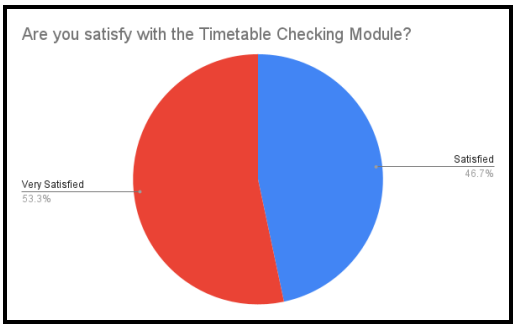

Figure 22: Timetable Checking Module

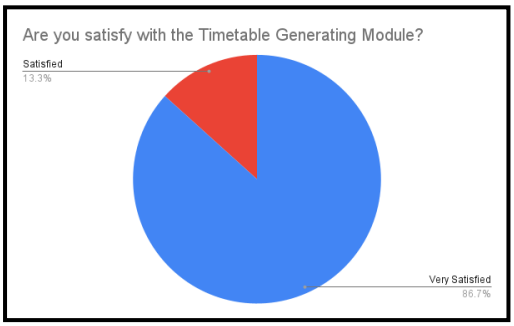

Figure 23: Timetable Generating Module

Figure 24 displays the user acceptance testing result on satisfaction with the History Timetable Module. Among 30 testers, 13 testers (43.3%) very satisfied with History Timetable Module while 12 testers (13.3%) satisfied with it whereas 5 testers (16.7%) neutral with it.

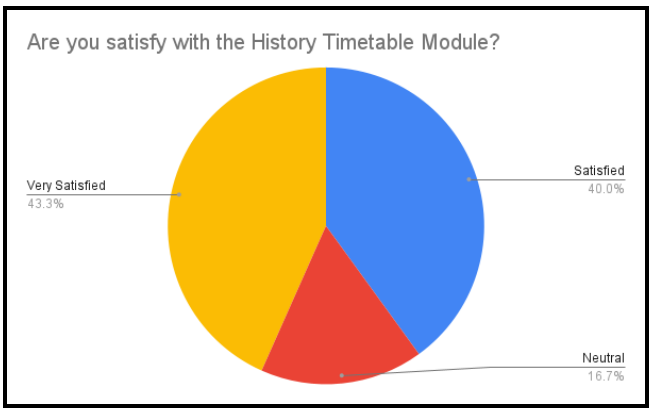

Figure 24: History Timetable Module

3.5.2.3 Section C

In Section C, there are 2 questions asked towards the testers. Figure 25 displays the user acceptance testing result on satisfaction with the Course Timetable Checking Module. Among 30 testers, 17 testers (56.7%) very satisfied with Course Timetable Checking Module while 13 testers (43.3%) satisfied with it. Figure 26 displays the user acceptance testing result on satisfaction with the Student Timetable Checking Module. Among 30 testers, 22 testers (73.3%) very satisfied with Student Timetable Checking Module while 8 testers (26.7%) satisfied with it.

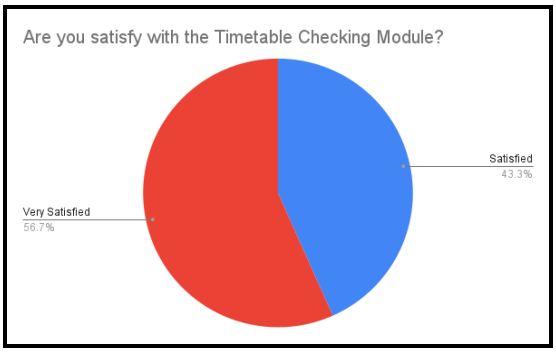

Figure 25: Timetable Checking Module

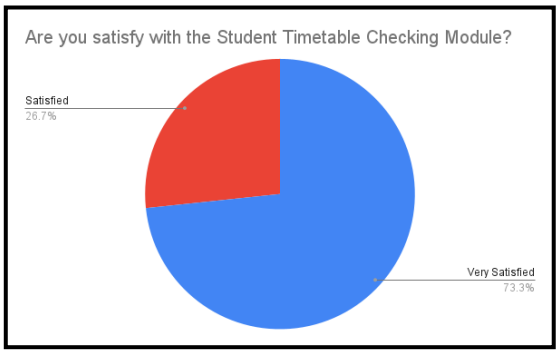

Figure 26: Student Timetable Checking Module

3.5.2.4 Section D

In Section D, there are 3 questions asked towards the testers. Figure 27 displays the user acceptance testing result on satisfaction with the User Management Module. Among 30 testers, 16 testers (53.3%) very satisfied with User Management Module while 12 testers (40.0%) satisfied with it whereas 2 testers (6.7%) neutral with it. Figure 28 displays the user acceptance testing result on satisfaction with the Course Management Module. Among 30 testers, 16 testers (53.3%) very satisfied with Course Management Module while 12 testers (40.0%) satisfied with it whereas 2 testers (6.7%) neutral with it.

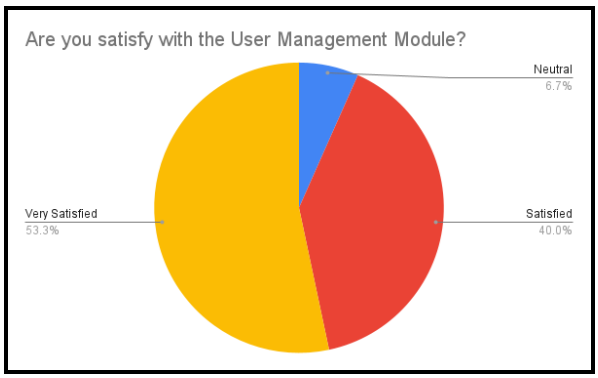

Figure 27: User Management Module

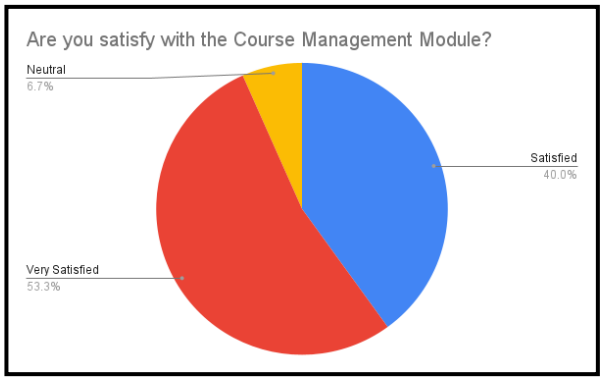

Figure 28: Course Management Module

Figure 29 displays the user acceptance testing result on satisfaction with the Section Allocate Module. Among 30 testers, 17 testers (56.7%) very satisfied with Section Allocate Module while 12 testers (40.0%) satisfied with it whereas 1 testers (3.3%) neutral with it.

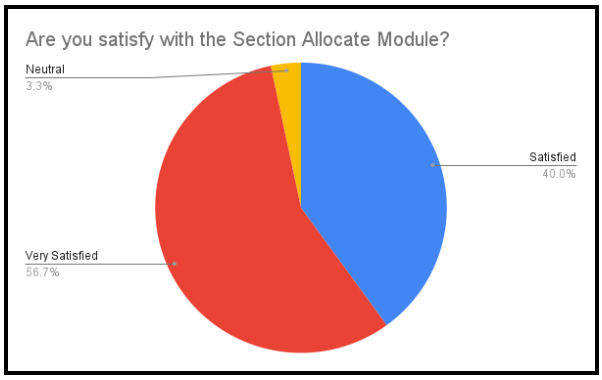

Figure 29: Section Allocate Module

4. Conclusion

In conclusion, the proposed system UTHM course timetable organizer system achieved the objectives of the project. The implementation system successfully solve course conflict issues and optimize the timetable generation process. The system able to help all user of system to reduce the workload and provides errorless during timetable planning. These functionalities enable user to perform various tasks effectively and smoothly.

4.1 System Advantages

The UTHM course timetable organizer system offers several significant advantages. It provides an easy way to generate course timetables, ensuring that course conflicts are avoided and thus improving the overall scheduling process. This system streamlines the scheduling process, making it more efficient and less prone to errors. Additionally, it facilitates the easy management of students' timetables for lecturer to check correctness of timetable for student under advising. Furthermore, the system enables direct communication between administrators and students, enhancing transparency and responsiveness in timetable management.

4.2 System Disadvantages

Despite these advantages, the UTHM course timetable organizer system also presents certain disadvantages. Only administrators are allowed to create users, which can delay the addition of new participants. The system lacks a course registration feature, which is crucial for managing enrollments effectively. Additionally, it only includes course timetables and does not provide schedules for lecturers, rooms, or batches, limiting its comprehensiveness. There is also no weekly timetable function to account for replacement classes, making it difficult to manage schedule changes. Furthermore, the generated timetables often lack essential information such as the names of lecturers and room assignments, reducing their overall utility.

4.3 Future Enhancements

Based on the analysis of the system's performance, several recommendations have been formulated to enhance its effectiveness and address identified challenges. These recommendations include implementing a user registration page to allow users to self-register, incorporating a course registration system to streamline course enrollment, and adding timetables for lecturers, rooms, and batches to create a more comprehensive scheduling solution. Additionally, introducing a weekly timetable function would facilitate regular updates, including replacement classes. Finally, ensuring that generated timetables include detailed information such as lecturer names and room assignments would greatly improve their clarity and usability.

Acknowledgement

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design**: Tan Hong Ming, Rozanawati Darman; **data collection**: Tan Hong Ming, Rozanawati Darman; **analysis and interpretation of results**: Tan Hong Ming, Rozanawati Darman; **draft manuscript preparation**: Tan Hong Ming, Rozanawati Darman. All authors reviewed the results and approved the final version of the manuscript.

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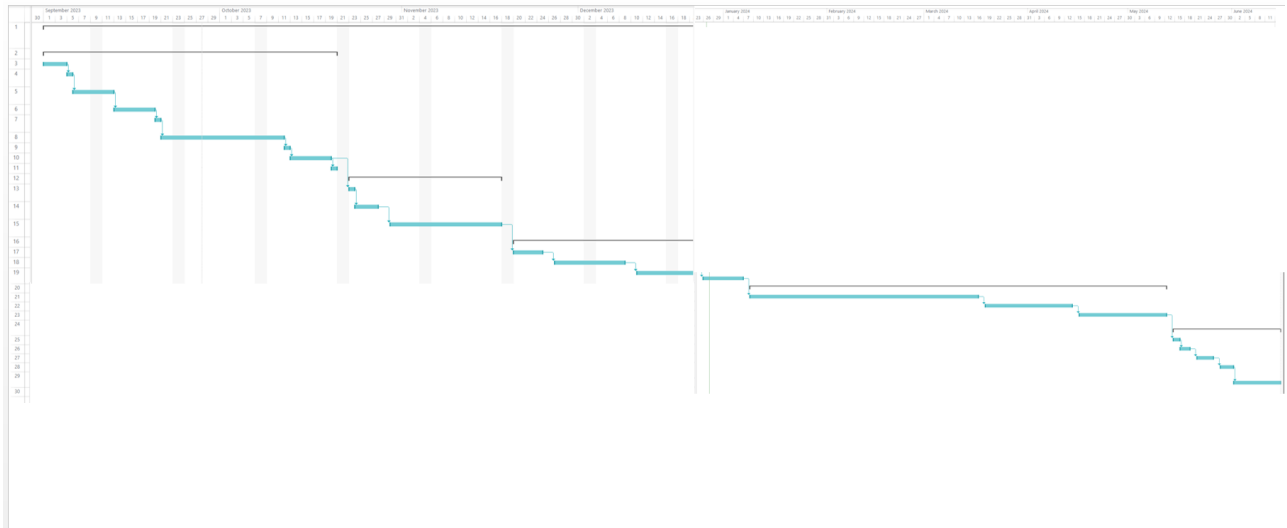
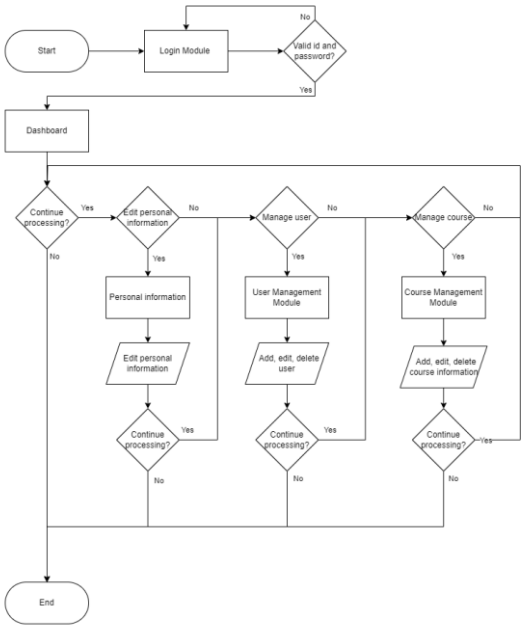
Appendix A: Gantt Chart

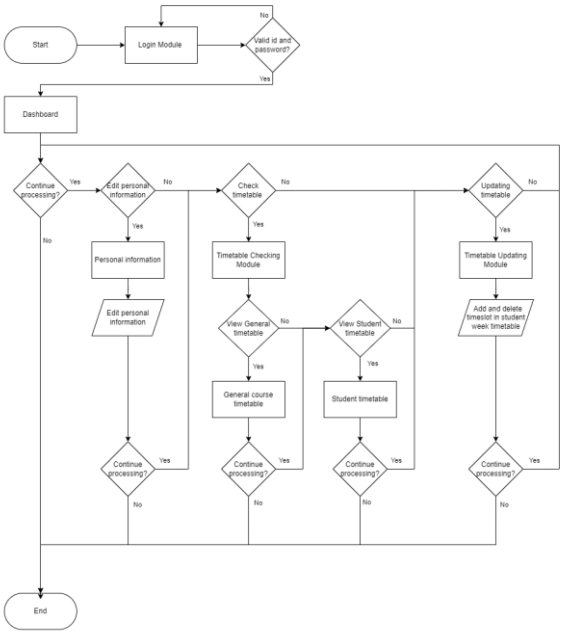
	Task Mode	Task Name	Duration	Start	Finish	Predecessors
1		**UTHM course timetable organizer system**	**205 days**	**Fri 9/1/23**	**Thu 6/13/24**	
2		**Planning**	**36 days**	**Fri 9/1/23**	**Fri 10/20/23**	
3		Identify Problem	2 days	Fri 9/1/23	Mon 9/4/23	
4		Identify Project Title	1 day	Tue 9/5/23	Tue 9/5/23	3
5		Identify problems statement	5 days	Wed 9/6/23	Tue 9/12/23	4
6		Identify Objective	5 days	Wed 9/13/23	Tue 9/19/23	5
7		Discuss Title with Supervisor	1 day	Wed 9/20/23	Wed 9/20/23	6
8		Proposal	15 days	Thu 9/21/23	Wed 10/11/2	7
9		Proposal Defence	1 day	Thu 10/12/23	Thu 10/12/23	8
10		Finalize Proposal	5 days	Fri 10/13/23	Thu 10/19/23	9
11		Design Gantt Chart	1 day	Fri 10/20/23	Fri 10/20/23	10
12		**Analysis**	**20 days**	**Mon 10/23/2**	**Fri 11/17/23**	
13		Observation and Interview	1 day	Mon 10/23/23	Mon 10/23/23	10
14		Analyze User Requirement	4 days	Tue 10/24/23	Fri 10/27/23	13
15		Analyze Existing System	15 days	Mon 10/30/23	Fri 11/17/23	14
16		**Design**	**35 days**	**Mon 11/20/2**	**Fri 1/5/24**	
17		Flowchart Design	5 days	Mon 11/20/2	Fri 11/24/23	15
18		DFD Design	10 days	Mon 11/27/2	Fri 12/8/23	17
19		ERD Diagram Design	10 days	Mon 12/11/23	Fri 12/22/23	18
20		Wireframe	10 days	Mon 12/25/2	Fri 1/5/24	19
21		**Implementation**	**90 days**	**Mon 1/8/24**	**Fri 5/10/24**	
22		Develop System	50 days	Mon 1/8/24	Fri 3/15/24	20
23		Decorate System	20 days	Mon 3/18/24	Fri 4/12/24	22
24		Connect System to Database	20 days	Mon 4/15/24	Fri 5/10/24	23
25		**Maintenance**	**24 days**	**Mon 5/13/24**	**Thu 6/13/24**	
26		Unit Testing	2 days	Mon 5/13/24	Tue 5/14/24	24
27		Integration Testing	3 days	Wed 5/15/24	Fri 5/17/24	26
28		System Testing	5 days	Mon 5/20/24	Fri 5/24/24	27
29		User Acceptance Testing	4 days	Mon 5/27/24	Thu 5/30/24	28
30		Bug fix	10 days	Fri 5/31/24	Thu 6/13/24	29



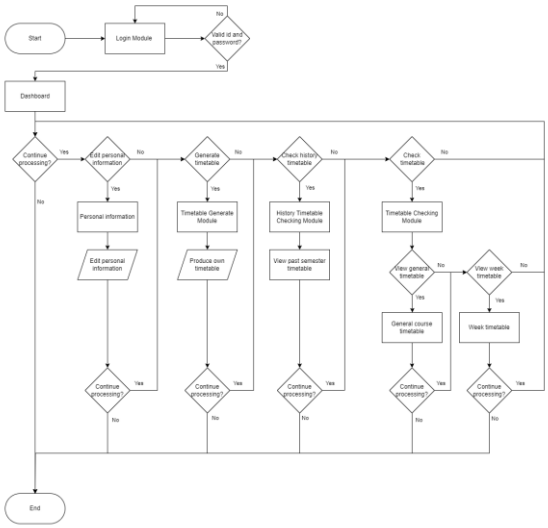
Appendix B: Flowchart for administrator



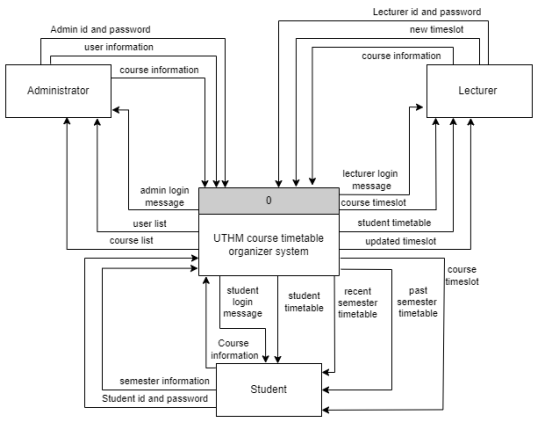
Appendix C: Flowchart for lecturer



Appendix D: Flowchart for student



Appendix E: DFD Context Diagrams



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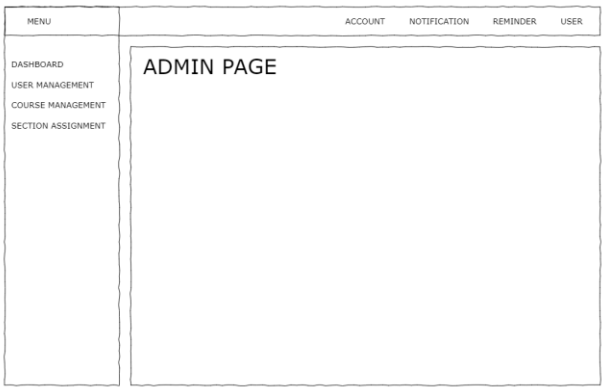
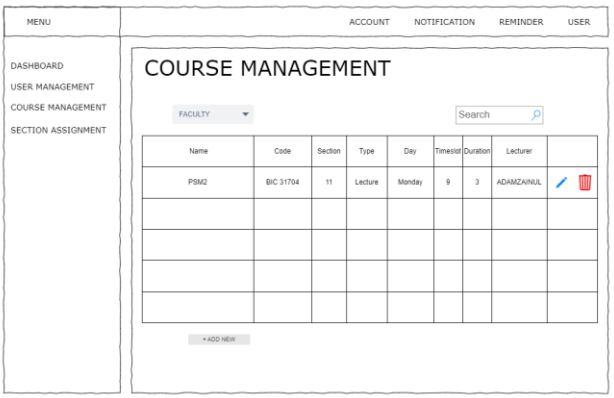
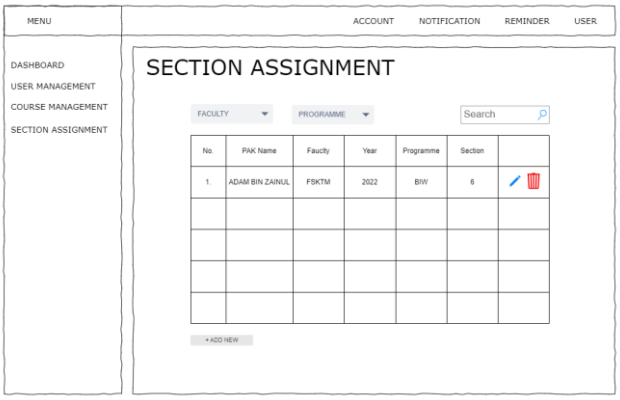
Appendix F: List of GUI design

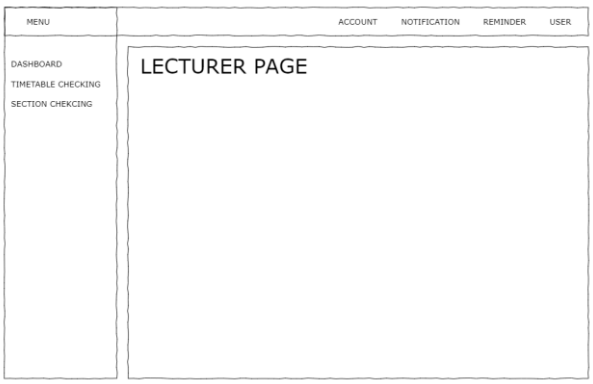
Admin Side

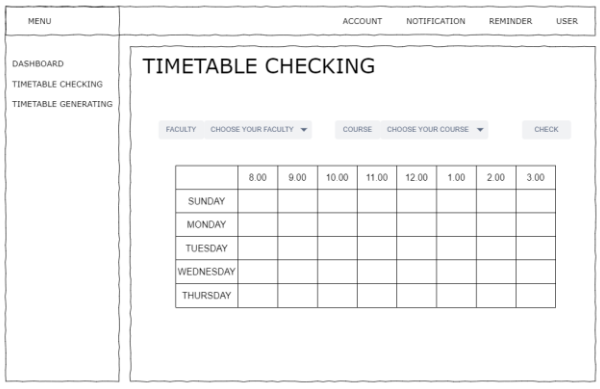


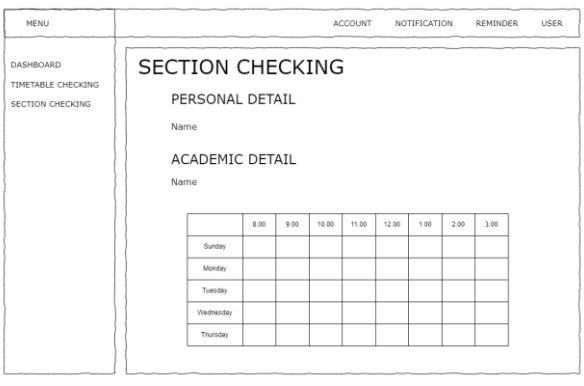




Lecturer Side







Student Side