

WEB-BASED SCHEDULING SOFTWARE FOR A UNIVERSITY

By

ONG BOON CHUN

A REPORT

SUBMITTED TO

Universiti Tunku Abdul Rahman

in partial fulfillment of the requirements

for the degree of

BACHELOR OF INFORMATION SYSTEM (HONS)

INFORMATION SYSTEM ENGINEERING

Faculty of Information and Communication Technology
(Kampar Campus)

JAN 2020

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DECLARATION OF ORIGINALITY

I declare that this report entitled “**WEB-BASED SCHEDULING SOFTWARE FOR A UNIVERSITY**” is my own work except as cited in the references. The report has not been accepted for any degree and is not being submitted concurrently in candidature for any degree or other award.

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I would like to express my sincere thanks and appreciation to my supervisors, Ts Chan Lee Kwun who has given me this bright opportunity to engage in a website design project. It is my first step to establish a career in website design field. A million thanks to you.

I must say thanks to my parents and my family for their love, support and continuous encouragement throughout the course.

ABSTRACT

This project is a website design project that create a web-based scheduling software for a university. The motivation to develop this project is to provide improved function and better user experience in timetable scheduling. The challenge in this project are it need to generate a timetable that able to solve hard constraints and soft constraint in timetable and importing .XLSX file from a pc to the website. By developing this project, user able to user this project to overcome the problem they face such as generate timetable manually, importing data into software and overcome the constraints and conflict in the timetable.

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LIST OF ABBREVIATIONS

<i>XML</i>	Extensible Markup Language
<i>XLSX</i>	Excel Microsoft Office Open XML Format Spreadsheet file
<i>MXT</i>	Geographical map template

Chapter 1 Introduction

1.1 Problem Statement

Scheduling timetable in university is a complex task that involves on what subject student take, lecturer availability and venue requirement. Given that there is a set of lecturers, set of class, set of rooms and hours of lecture in 1 week. Usually, timetable is created manually and it can be a very time-consuming task and frustrating for the teachers (Fedena Blog, 2018). Web-based scheduling software need to solve these conditions in order to generate crash free timetable that can help user to optimize the university resources perfectly.

After that, Scheduling software need to able to import data from university to get all students, lecturers and other data to generate a timetable that suit university. Manually insert the data will cost management of university a lot of time because there are thousands of teachers, rooms and hundreds of subject to insert.

Next, every university timetable will include a table that contains details of the classes such as day of the classes, time of the classes, subject name of each class and others. A good sorting in the details table is important because it is used by lecturer and administrator of the software to check which classes will be lectured on which day. In figure 1.1, it shows the UTAR timetable details table is sorted by number that cause lecturers need to check the list one by one to know which classes they will be lecture on which day.

Lastly, another challenge of web-based scheduling software is it needs generate a timetable that overcomes constraints of the timetable so the timetable will able to work perfectly. Each hard constraint is an element of the timetable that is equally weighted and must be abided by. (Ben Moreland, 2015). Hard constraints are those constraints that must be strictly fulfilled. If the software not able to overcome hard constraints, the timetable created will never be worked for university. For soft constraints, it is not important as hard constraints but solving soft constraint able to help management of university to generate a good timetable to a great timetable.

The following are hard constraints and soft constraints that needs to overcome:

Hard Constraints

- Available of rooms during the time slot.
- Available of lecturer during the time slot.
- Available of time slot in timetable.

Soft Constraints

- Lecturer consecutive teaching hours

No	Unit	Description	Type	Class Group	Attendance Total Hours	Day	Time	Hour
1	UCCA3234	DATABASE ADMINISTRATION	L	1	View	Mon	11:00 AM - 1:00 PM	2.0
						Wed	11:00 AM - 12:00 PM	1.0
2	UCCD2044	OBJECT-ORIENTED PROGRAMMING PRACTICES	P	6	View	Mon	1:00 PM - 3:00 PM	2.0
3	UBMM2013	OPERATIONS MANAGEMENT	T	1	View	Mon	4:00 PM - 5:00 PM	1.0
4	UCCD1113	INTRODUCTION TO MULTIMEDIA	T	1	View	Tue	11:00 AM - 12:00 PM	1.0
5	UCCA3234	DATABASE ADMINISTRATION	P	1	View	Tue	4:00 PM - 6:00 PM	2.0
6	UCCD1113	INTRODUCTION TO MULTIMEDIA	L	1	View	Wed	8:00 AM - 10:00 AM	2.0
						Thu	1:00 PM - 2:00 PM	1.0
7	UCCD2044	OBJECT-ORIENTED PROGRAMMING PRACTICES	L	1	View	Wed	2:00 PM - 4:00 PM	2.0
						Thu	11:00 AM - 12:00 PM	1.0
8	UBMM2013	OPERATIONS MANAGEMENT	L	1	View	Wed	4:00 PM - 6:00 PM	2.0

Figure 1.1: an example of details table of university timetable

1.2 Project Scope

The software currently will be a web-based software that can be used on personal computer or company computer. The expected end product for this project would be a system that can performs timetable scheduling on web browser. This software will check the hard constraints of the timetable and notify user to change the time slot, lecturer or room of the inserted subject.

Another scope for this project is to import data from xlsx file into database. University data are needed in this software in order to create a timetable. Due to the large amount of data in university, an import data module is needed in this project to reduce user scheduling time and improve efficiency of scheduling.

Last scope for this project would be the user friendliness of the project. Provide more user-friendly software will improve the experience of user using the software. For example, better sorting of the timetable details table able to improve user experience.

1.3 Project Background and Motivation

A university timetable is a reference document created by using scheduling that clearly shows how university resources, such as lecturer and venue, fit together with student schedules and university schedules, as well as with days of the week. Scheduling is a process of arranging, controlling and optimizing the task and activities that must be subjective to different constraints (En.wikipedia.org, n.d.). A well planned, well throughout and a clash free timetable is one of the most important key factors in managing the university. Back in the day when the technology has not developed like now, timetable is created by the management in university manually. As for now, most of the timetable in university is created by timetable scheduling software which took lesser time to schedule a clash free timetable compare to timetable created manually (Jain, 2018).

A university timetable is a table coordinating these five elements:

- Students
- Lecturer/Tutor
- Rooms/Venue
- Time Slots
- Subject

The motivation of this project is to develop a web-based scheduling software that able to improve efficiency and user friendliness to user. Compare to desktop application, web-based timetable scheduling software is more convenience for user since user able to access to the web-based software using any computer at any place as long as the internet is available while desktop application needs to install the application first before able to use.

Chapter 1: Introduction

Day/Time	07:00	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00
	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00
Mon				N002 MPU34012(L)(2) 1-7												
Tue							LDK5 UCCD2502(L)(1) 1-7									
Wed				N002 MPU34012(L)(2) 1-7		N010(Lab) UCCD2513(T)(4) 1-7				LDK5 UCCD2502(L)(1) 1-7						
Thu			N110(Lab) UCCD2513(T)(4) 1-7		N010(Lab) UCCD2502(T)(10) 1-7											
Fri																
Sat																
Sun																

Figure 1.2: an example of university timetable

1.4 Project Objective

Scheduling software is a part of important roles for university management when it comes to scheduling timetable. Scheduling software able to improve the efficiency, reduce time and help management to overcome scheduling problem which is very complex. There are several objectives in this project, the first objective is to develop and deliver a software that able to overcome hard and soft constraints of timetable scheduling. A good timetable scheduling software able to solve hard and soft constraints so user able to develop a timetable without any crashes.

Next, second objective will be to develop an improved scheduling software to give a better user experience for user. Develop a scheduling software that have functionality and features that are improved so software is more user friendly. For example, sorting the list of class by day instead of number. A simple sorting in software able to provide user friendly because user can easily know which day have which classes.

Lastly, the third objective is to identify necessary module needed for timetable scheduling. To solve the problem in problem statement, identify the necessary module needed in the project so that this project able to solve the problem. For example, insert university data in software take large amount of time. Including an import data module able to reduce user insert data time.

As a summary, the objectives for this project are to develop and deliver a software that able to overcome hard and soft constraints of timetable scheduling. Next, develop an improved scheduling software to give a better user experience for user. Lastly, identify necessary module used for timetable scheduling.

1.5 Proposed approach

Figure 1.3 illustrated the system flow of the web-based timetable scheduling software in the project. The proposed approach is use PHP programming language and Laravel framework to develop a software that can perform timetable scheduling on web. First of all, Lecturer or admin will login to the website. If user log in as a lecturer, the website will proceed user to the lecturer page which display classes they need to teach and details of the classes. Moreover, lecturer user can check the announcement board when administrator make announcement. User login with administrator account will proceed to admin main menu page. Next, administrator user can insert or import excel file of necessary data to the database. User can edit the data or delete data on every data page. User can insert classes into timetable and any constraints or crash in the timetable will notify administrator user. Lastly, user able to send notification to user through email when scheduling is completed and make announcement on announcement board.

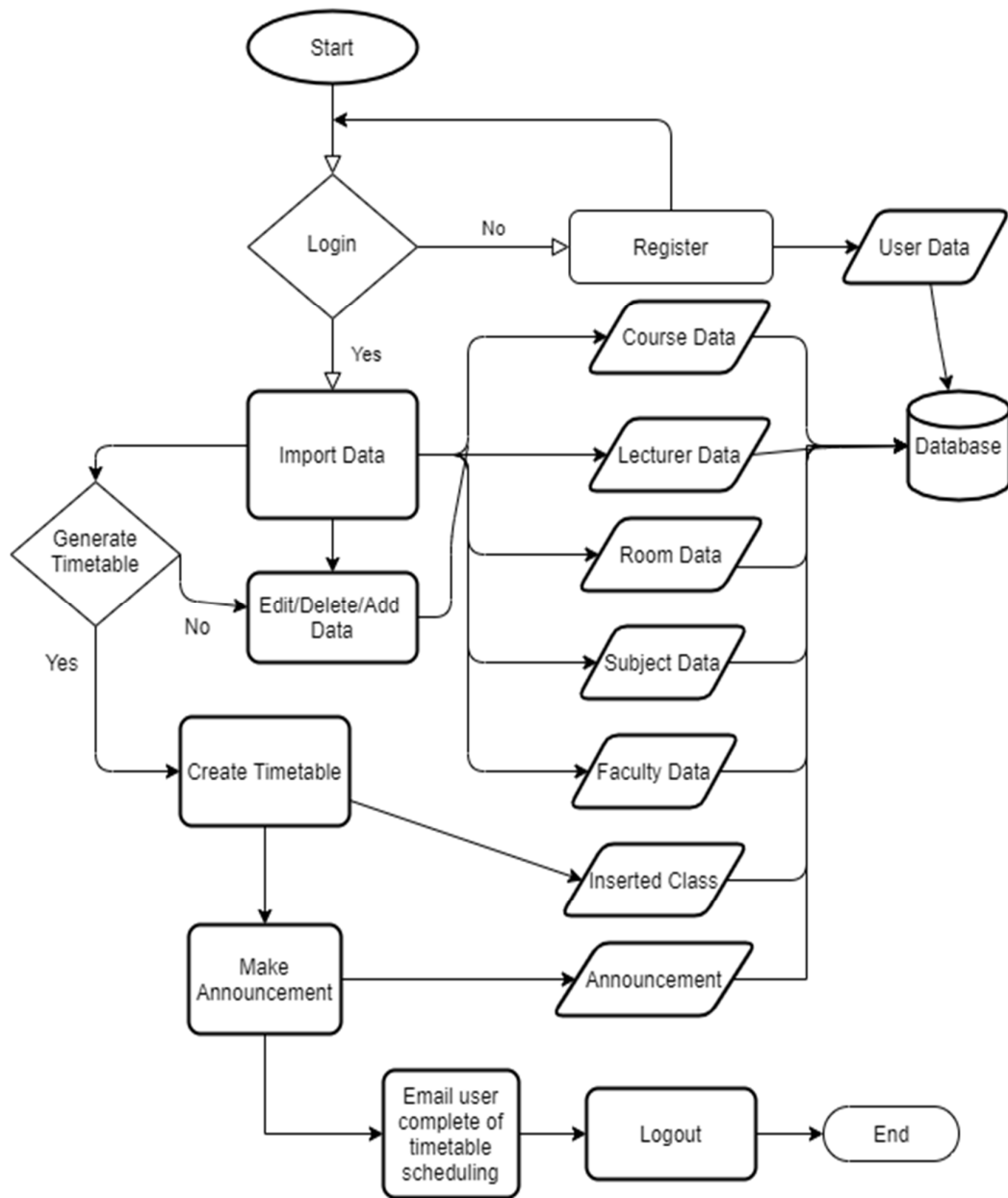


Figure 1.3: admin user flowchart of this project.

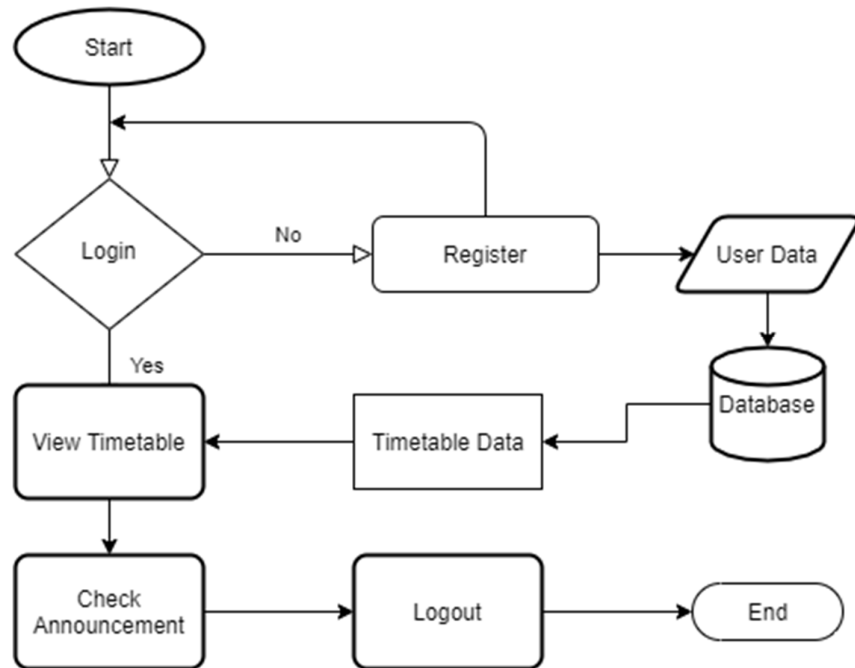


Figure 1.4: lecturer user flowchart of this project.

1.6 Impact, Significance and Contribution

Timetable scheduling software is one of the most commonly used software by the school and university management. It has a great impact towards the world. Most of the school and university are using scheduling software to schedule their timetable. Timetable software provides effortless timetable scheduling apart from an array of benefits to collages, school or any institution (Sriram, 2015).

This project able to benefits academic staff who perform timetable scheduling for university. With the use of import data module and announcement board module, academic staff able to improve efficiency by insert .XLSX file that contain all the data needed in the software and better communication between staff and lecturer.

Next, create a crash free timetable need huge amount of workload because need to check the crashes between lecturer, room and time slot. This project include module to check the crashes for user so user able to reduce their time and workload to check the constraints.

1.7 Highlight what have been achieved

Firstly, the database of the website has been created for storing data needed to generate timetable. After user import data or insert data one by one, the data will be stored in Microsoft SQL server database and all database data will listed in table form for user to perform edit or delete data in the database before performing scheduling.

Next, Timetable scheduling has been achieved in this project, user able to insert classes into timetable and any class crashed by lecturer, room or classes will notify user to change the classes. Once user done generating timetable, user can save the timetable and print it out.

Contributions of this project are this project able to reduce the time and workload of user to scheduling a timetable. For example, import data module that insert data from excel file to database reduce user insert data time. It also provides more user-friendly software to user such as it able to let user generate timetable and check timetable based on course. It also provides better user experience to user. The announcement board module able to improve communication between lecturer and staff and lecturer able to view their timetable with a good sorting to the class details table in the timetable.

1.8 Web-Based Scheduling Software

In this project, we are focusing on creating web-based scheduling for university that able to generate a crash free timetable. It combines and evaluates several objectives and constraints according to the goals of the University, optimizing timetables for academic staff, students and classrooms (Bullet Solutions, 2017). Web-based scheduling software will gather all the resources of the university before generate the timetable. This software able to help to increase efficiency, reduce time and reduce cost of the university management especially management that generate timetable manually.

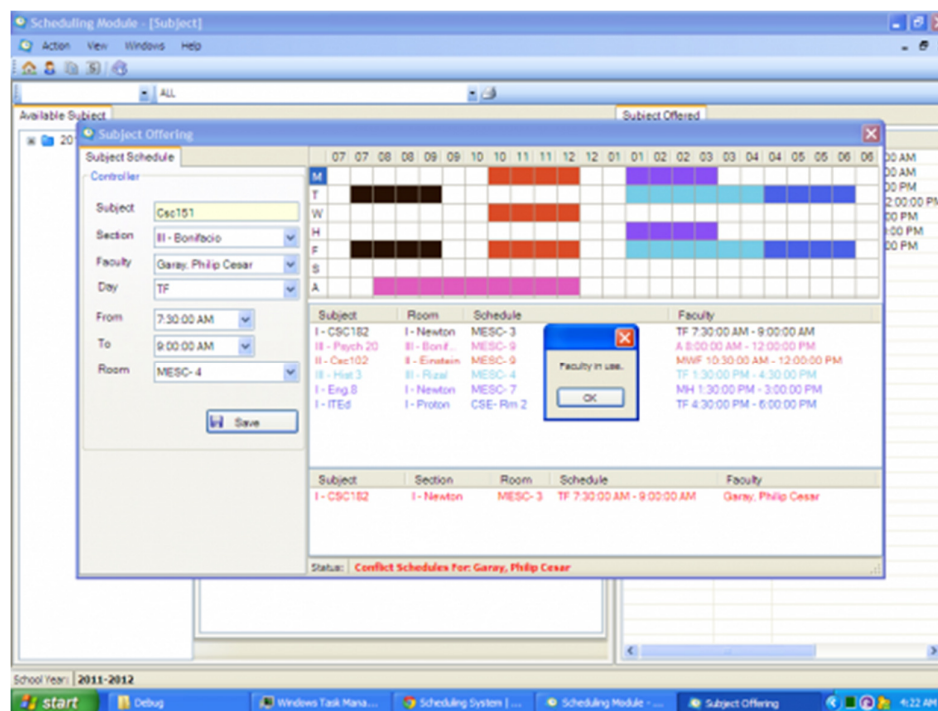


Figure 1.5: Example of Timetable Scheduling Software (itachi_philip, n.d)

1.9 Report Organization

The thesis was organized into six chapters. The outline was as follows:

- Chapter 1 Introduction

The introduction of the research project, including the problem statement and motivation, project objectives, project scope, contribution of the project, the background information of the project and highlighting what have been achieved in this project will be stated.

- Chapter 2 Literature Review

The literature review will be focused in this chapter. The literatures related in the area of research that being studied will be reviewed in this chapter. A brief discussion of literatures will be stated.

- Chapter 3 System Design

The system design of the proposed system. This chapter will further explain about the system's structure, architecture, process flow, functionalities of processes and so on.

- Chapter 4 Methodology, Tools and Design of Module

This chapter will mention about the methodologies for the proposed system, tools, requirements and design of each module.

- Chapter 5 System Implementation and Testing

This chapter will show the test case of the testing module.

- Chapter 6 Conclusion

This chapter will conclude all the previous discussions of this research project. The future improvements that can be implement into the system will also be included in this chapter.

Chapter 2 Literature Review

2.1 Literature Review

Scheduling software is the process of creating and maintaining a scheduled timetable. There are different types of scheduling software that has been used by user for many years such as aSc Timetables, Prime Timetable and Mimosa. Different type of scheduling software performs different way with the features they have. Therefore, the review of some scheduling Software features has been conducted.

Table 2.1 is features that included in the timetable scheduling software:

features / Software Name	aSc Timetables	Prime Timetable	Mimosa	Proposed Web-based Scheduling Software
Generate Timetable	✓	✓	✓	✓
Manage Data	✓	✓	✓	✓
Announcement Board and Notification	✗	✗	✗	✓
Data Import	✓	✓	✓	✓
Lecturer Timetable View	✗	✗	✗	✓
Charts	✗	✗	✗	✓

2.1.1 aSc Timetables (<https://www.asctimetables.com/>)

aSc Timetables is a timetable scheduling software that created more than 20 years and used by hundred thousand of school. It come with perfect scheduling which simply user enter the requirement and the software will evaluate over 5 million possibilities to come up a balanced schedule that meet the criteria user need (Asctimetables.com, n.d.). It also has been agreed by most of the teacher that aSc timetable is quick and easy scheduling software to use.

For the functionalities, figure 2.1 show that in main pages of aSc Timetables able to let user to key in lecturer, subjects, classes and classrooms data into the software. As stated in the problem, key in data one by one will took a lot of time due to there is a lot of data for user to key in. aSc timetable include data import features into their software which able to help user to input data into software quicker by just importing data file from pc into software as show into figure 2.2. The limitation of this feature is that the software only accepts data file that is in XML type (Help.asctimetables.com, n.d.). User need to change their data file from other type to XML in order able to import data into this software.

Next, once all the data is import into software, user need to do is to click generating timetable and it will generate the timetable automatically that overcome constraints. If the automate generated timetable is not suitable, user can generate a new one until the one they wanted to. User also can manually adjust the timetable themselves instead of keep generating new timetable which is more effective and quicker to change the timetable suit the school.

Lastly, the weakness of aSc timetable is it lack of lecturer to view the timetable. The software is made for administrator or staff use only. Including lecturer own timetable for lecturer able to give convenient to lecturer to view which class they need to attend for the semester so that lecturer do not need to search the class in the timetable one by one.

Chapter 2: Literature Review

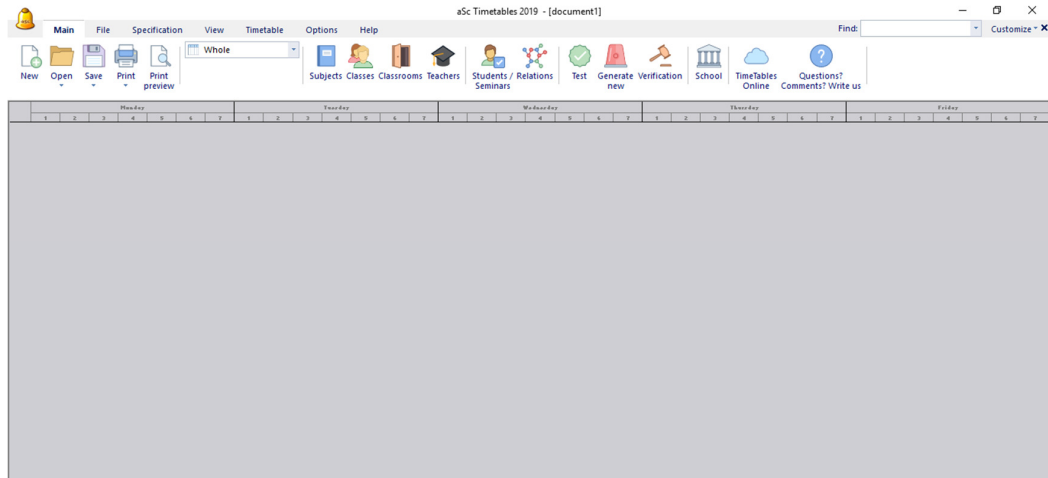


Figure 2.1: the main of the aSc Timetable software.

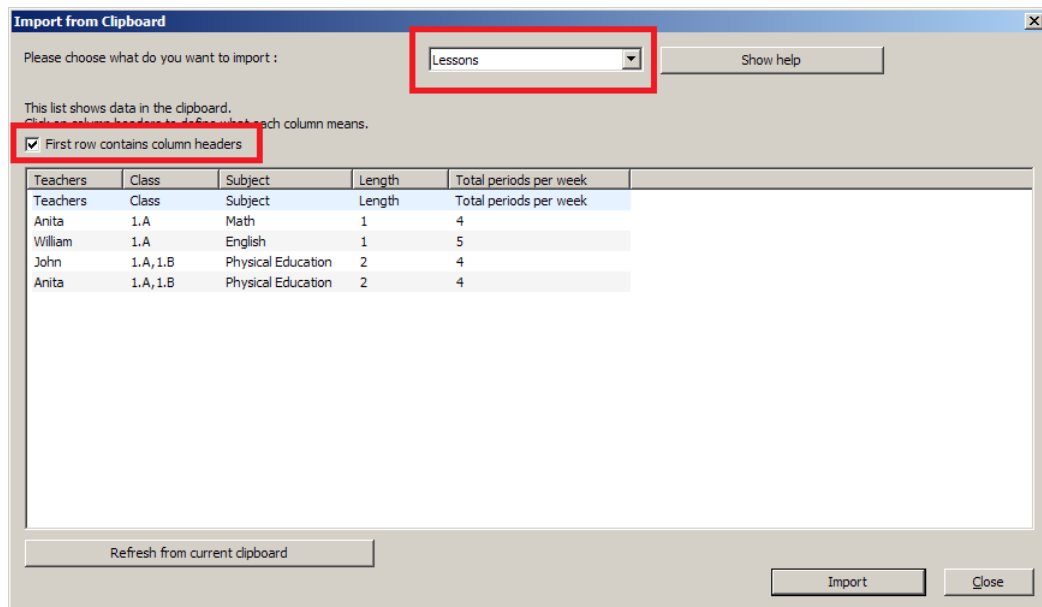


Figure 2.2: how to import data

2.1.2 Prime Timetable (<https://primetimetable.com/>)

Prime Timetable is used for scheduling primary, junior, high schools, international schools, universities and other educational organizations as well as for scheduling various events: school camps and courses (Primetimetable.com, n.d.). The strength of Prime timetable is that it is a web-based timetable scheduling that able to do scheduling for user and generate timetable on website. A key advantage to web-based software is that all data is centralized and able to access over the web from any computer at any place, any time. (Basecamp.com, 2018).

Once user logging into website with username and password, User able to manage and key in days, subjects, teachers, rooms and classes as show in figure 2.3. Prime Timetable includes data import like aSc timetable for user which able to reduce time for user to insert data one by one. Prime Timetable use copy and paste data from excel and .XML type file to import data into the software just like aSc timetable (Primetimetable.com, 2018).

Next, user can put and adjust the resources into the timetable manually that suit to their university and school. Once complete the timetable, user able to resolve all the constraints and conflict by just clicking remove constraints button in the website and the system will resolve constraints and conflict for user.

Lastly, the limitations of Prime Timetable are it only allow user to generate timetable manually. Prime Timetable are more focusing on primary and secondary school timetable. It lacks of the necessary functionality like create different timetable for different course and different faculty. The lack of these necessary functionality causes Prime Timetable are not suitable for university institution to generate timetable on their software.

Chapter 2: Literature Review

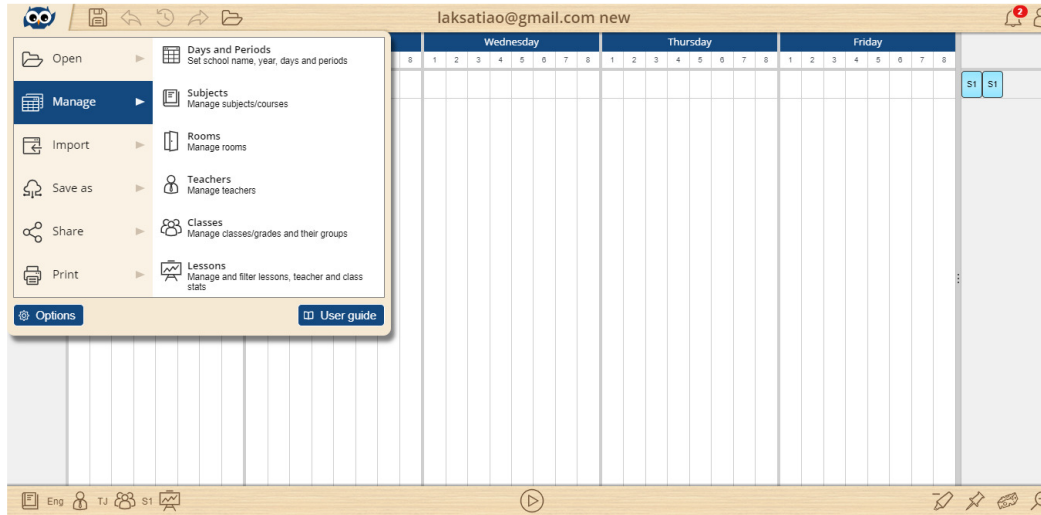


Figure 2.3: the main page of Prime Timetable and the functionalities.

2.1.3 Mimosa (<http://www.mimosasoftware.com/>)

Mimosa Software Ltd. Founded in 1986. The primary focus of the company is development of the Mimosa Timetable Scheduling Software, which is designed for all kind of institutes, organization and companies in worldwide (Mimosasoftware.com, n.d.). The strength of Mimosa is Mimosa not a supporting tool to particular organization scheduling process. Instead, Mimosa focuses on the main challenges of timetable scheduling and provides user cantered solution for those. As a result, Mimosa Timetable Scheduling Software able to used in school, university and organization for timetable scheduling.

After that, Figure 2.4 shows main menu of the Mimosa software that able user to add, edit and remove all the resources and event on the main menu. Compare to aSc timetable and Prime timetable, Mimosa able to let user import data by using. MXT text file which different from aSc timetable that use XML file and Prime timetable that use copy and paste the data from excel. Next, Mimosa have auto allocation event into timetable so user able to manual adjust the timetable.

Lastly, limitation of Mimosa timetable scheduling software is the type of file to import data into software. Most of the user store data in database and excel file. MXT file are less commonly used type of file compare to excel.

Chapter 2: Literature Review

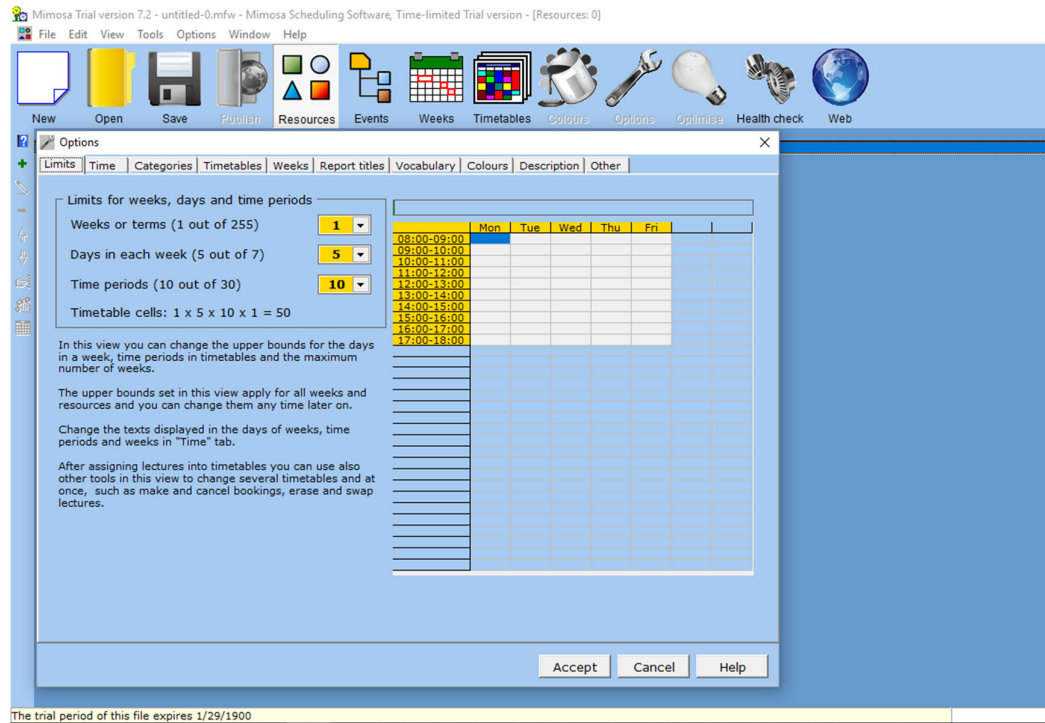


Figure 2.4: Mimosa software main menu

2.1.4 Proposed web-based scheduling software

In proposed web-based scheduling software, the software able to generate timetable that overcome all the constraint and meet the conditions user need to generate a clash free timetable for user. Most of the commercial scheduling software are focused on middle and high school timetable scheduling, this proposed web-based scheduling software focus on university timetable.

Next, software also allows user to manage data such as lecturers, students and rooms so user able generates the timetable that they needed and suit to the university. Moreover, the software also includes data import features which allow user to import and export with .XLSX type file which commonly used by most of the user to store data.

The software will also include two role of user which is Lecturer and Administrator. Lecturer role able to check administrator announcement and view their own timetable and classes details. For administrator role will perform generate timetable, insert data and make announcement on the announcement board. Lastly, admin able to send notification to lecturer by using email. Lastly, administrator user able to check chart to see the difference of number of subjects, number of rooms and number of courses in a faculty.

2.2 Algorithms for Generate Timetable Automatically

Generating timetable automatically need algorithm to solve the constraints in the timetable. The study has been conducted to different algorithms to see the difference of the algorithm on how it solves the constraints in the timetable and generate timetable automatically.

2.2.1 Genetic Algorithms

Genetic algorithms are the most commonly used algorithm to generate timetable. It able to generate number of solutions that overcome constraints and conflicts such as avoid clash of faculty, classroom slot and time in the timetable. The obtained solution has been found better that solution that has been manually prepared by management in university.

Genetic algorithm is a population based heuristic method that commonly used in timetable scheduling because it able to arrange a set of events in available slots with limited resources and constraints in a clash free timetable. Genetic algorithm is suitable to solving production scheduling problems, because unlike heuristic methods, genetic algorithms works on a population of solution rather than a single solution. (En.wikipedia.org, 2019).

There are five phases are considered in a genetic algorithm. The first phase is Initial Population. Initial population will create a set of population which each of them are the solution for the problem. Each of them is characterized by a set of parameters which called as genes. Genes will join string together and the outcome will be the chromosome which are solution. The probability of reproduction of an individual in population will base on the fitness score in the fitness function. Fitness function is the second phase will determine how an individual able to fit or compete with other individual and the function will give a score to each individual so the function will choose the best individual.

The third phase is Selection. The highest fitness scores individual will be selects in two pairs as a parent by comparing the fitness score. The highest fitness score

normally will be selected for reproduction. Next, Crossover is the fourth phased which each pair of parents paired, a random crossover point will be choose within a genes and offspring are generated by exchanging the genes among of the parent until it reaches to the crossover point.

In last phase of the genetic algorithm which is mutation, some of the genes in the new offspring formed are subjected to a mutation with a low random probability. This is for some of the bits in bits string to able to flip.

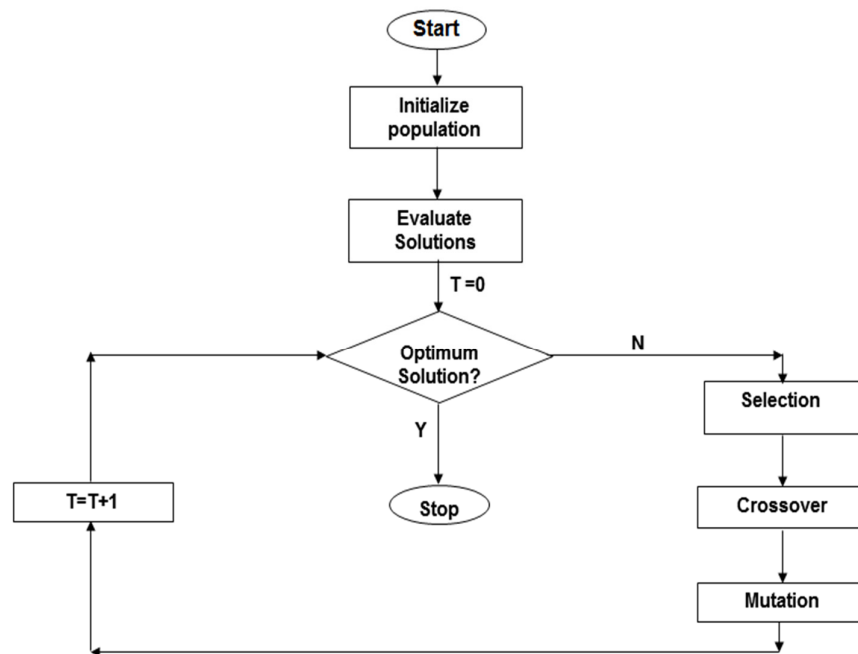


Figure 2.5: genetic algorithm works

2.2.2 Backtracking Algorithm

Backtracking Algorithm is an approach used to find all or most of the possible solution to the computational problems which also called as constraints satisfaction problems. Backtracking algorithm are faster than brute force enumeration because it can eliminate most of the possible solution in single test. Backtracking algorithm solve overall problem by solving the sub problem one by one. Algorithm will find a solution to solve the first sub problem and proceed to next sub problem based on the first solution. If the solution not able to solve second sub problem, it will backtrack and find next possible solution that able to solve first sub problem issues and current issues and then proceed further to solve other sub problems.

A good example to show how backtracking algorithm solve timetable scheduling constraints is n-queens problem. Placing 4 chess queens on a 4x4 chessboard so that the queens will not treat or attack any other. Using backtracking algorithm, we can find the possible solution candidates that the arrangement on queens on the board will not treat others. If the candidate solution contains two queens can attack each other, we can abandon the solution and find other possible candidate solution until 4 of the queens will not treat each other. In timetable scheduling, we can abandon the solution that the classes are crashed or other constraints problem and find the best solution for the timetable and generate it.

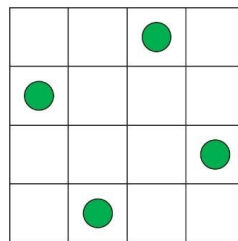


Figure 2.6: 4 queens not treating each other in a 4x4 chessboard

2.2.3 Critical Remarks of Previous Works

Case study about using genetic algorithm and heuristic search to solve timetable scheduling

The research done by (Lukas, Aribowo and Muchri, 2012). They completed the experiment using genetic algorithm to solve the timetable scheduling. By using genetic algorithm, they able to solve that every subject added in the system has allocated in the room without any crashes between the classes in the timetable. Once the system received the data such as day of restricted and lecturer time slot, classes time slot and room time slot. They run a population with 10 chromosomes and 10 generation in experiment without any crossover probability, mutation probability and selection probability. They able to get result of maximum best fitness value which is one. It means all the subject in the classes has own room, lecturer and timeslot in the timetable without any crashes.

2.3 Conclusion

As conclusion, this literature review has presented briefly about some of the scheduling software, functionalities of the software and algorithm used in generating a timetable automatically. A primary goal of scheduling processes in university academic should, therefore, be to maximize the probability that all students will the student will receive the course they needed in order to meet their degree requirement. (Blakersly et al., n.d.). Different software come with different features and functionalities, so choosing a suitable software able to improve the efficiency, reduce cost and reduce time of university management

Chapter 3 System Design/Overview

3.1 Flowchart

In this project, the process will start once user open the webpage. Once user open the webpage, the webpage will detect whether user login or not if not and will proceed user to the login page if they are not logged in. If user do not have account, user can go to register page to register the account either as admin or lecturer. The user account data will be store into database.

Once the user login successfully, user will bring to the home page of the website based on their position. Administrator user can choose to import data to the database or not to. If user choose to import data into database user can import data such as lecturer, subject, room and classes using data import module which user can import data from excel .xlsx file into database. User can choose not to import data and add the data at the manage data module which user able to create, edit and delete data in the database at the manage data module.

Once user complete import and manage data, user can start generate the timetable by inserting classes to the timetable to generate a timetable and display on the monitor. Lastly, administrator able to make announcement on announcement board and notify email about the timetable is generated.

As for user register as a lecturer position, they can view the timetable which include classes they will be lecturing in the semester and access to announcement board to check the announcement made by administrator.

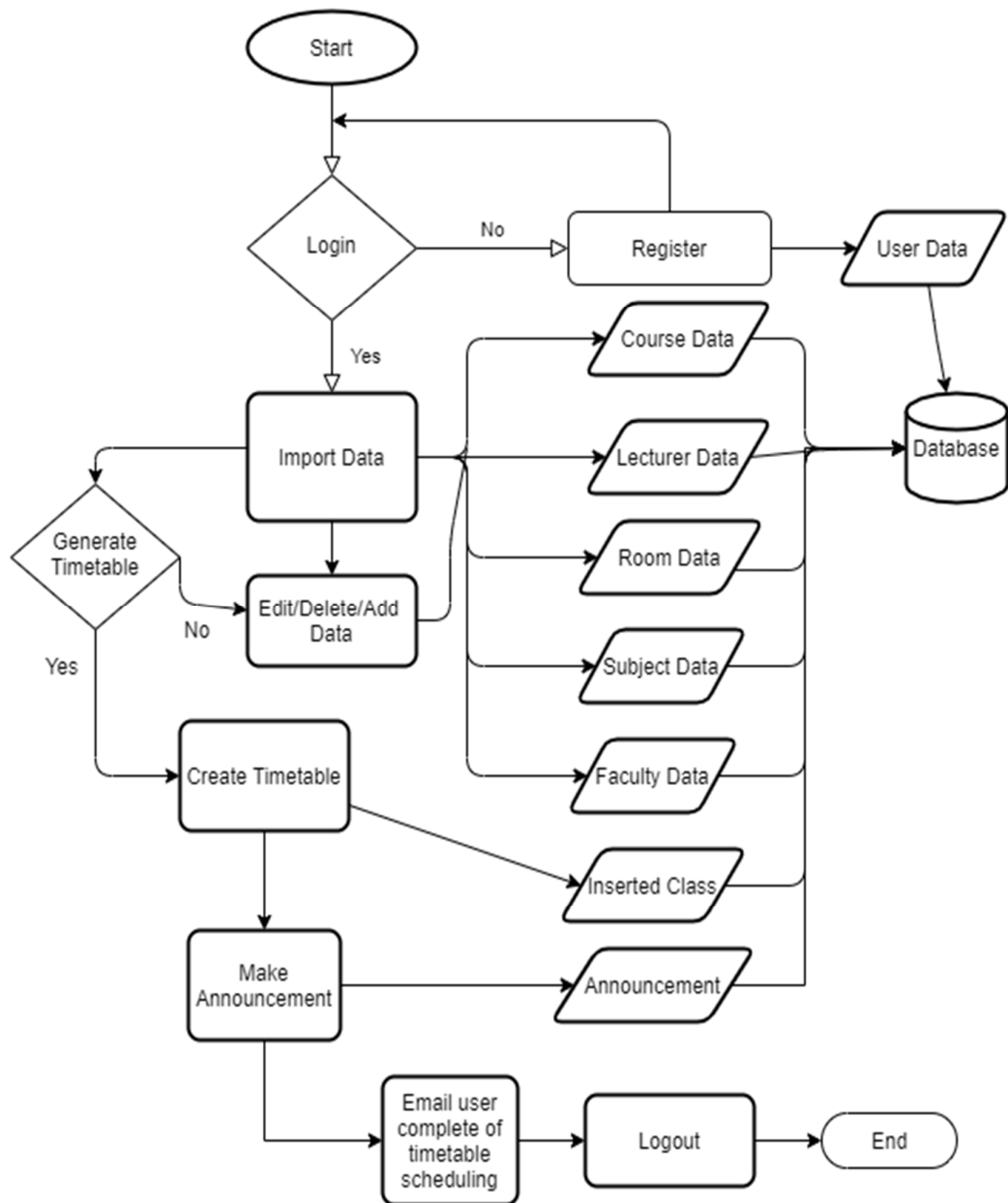


Figure 3.1: administrator user flowchart in the system.

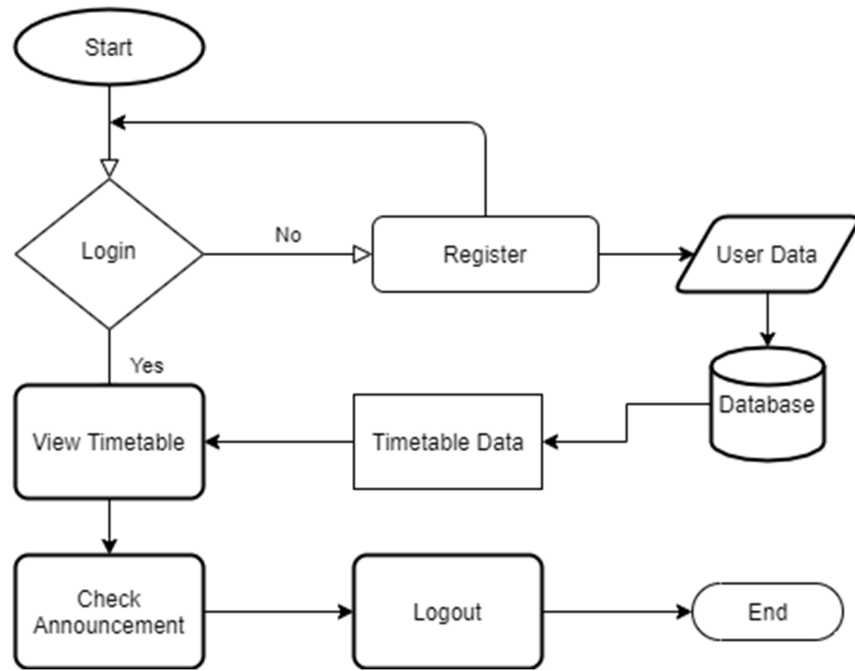


Figure 3.2: lecturer user flowchart in the system.

3.1.1 Flowchart for Manage Data Module

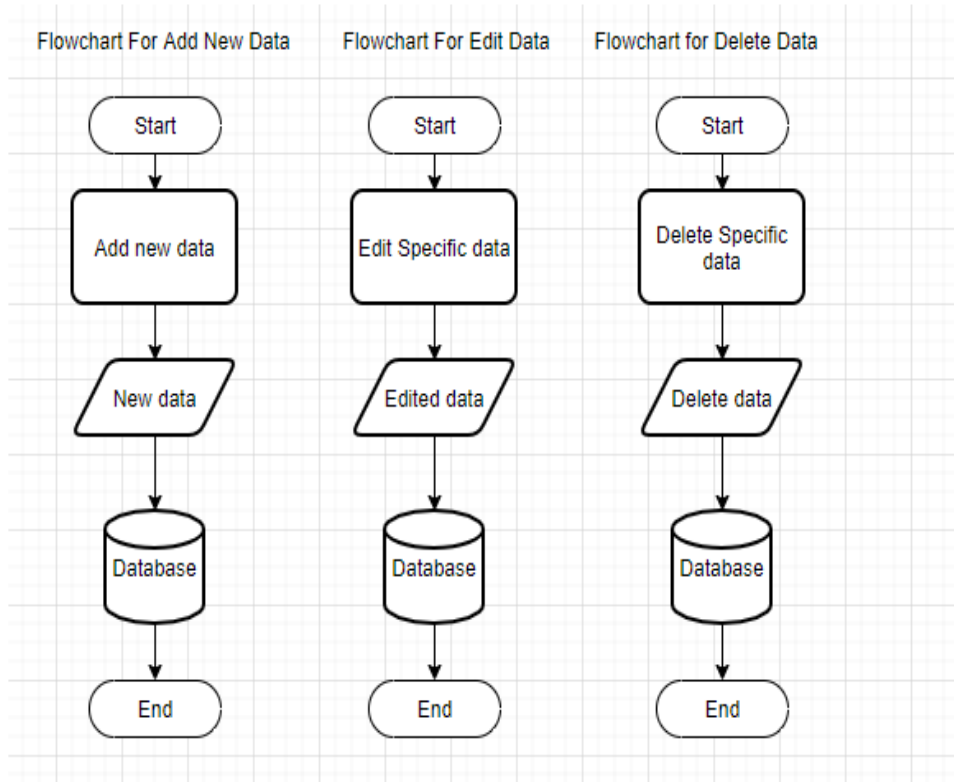


Figure 3.3: Flowchart of Manage Data module

3.1.2 Flowchart for Import Data Module

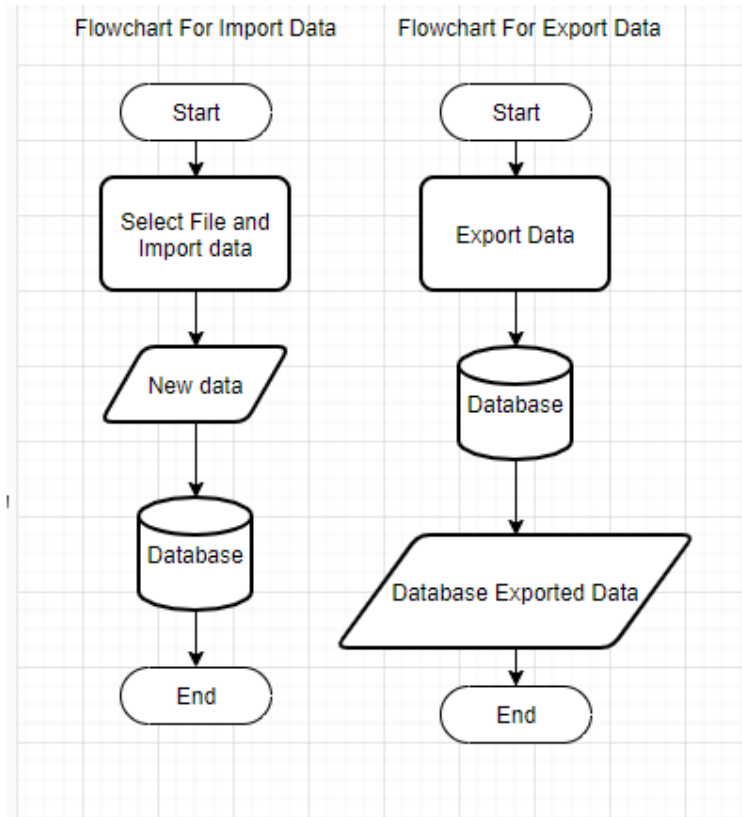


Figure 3.4: Flowchart of import and export data

3.1.3 Flowchart for Generate Timetable Module

Flowchart of insert class into timetable

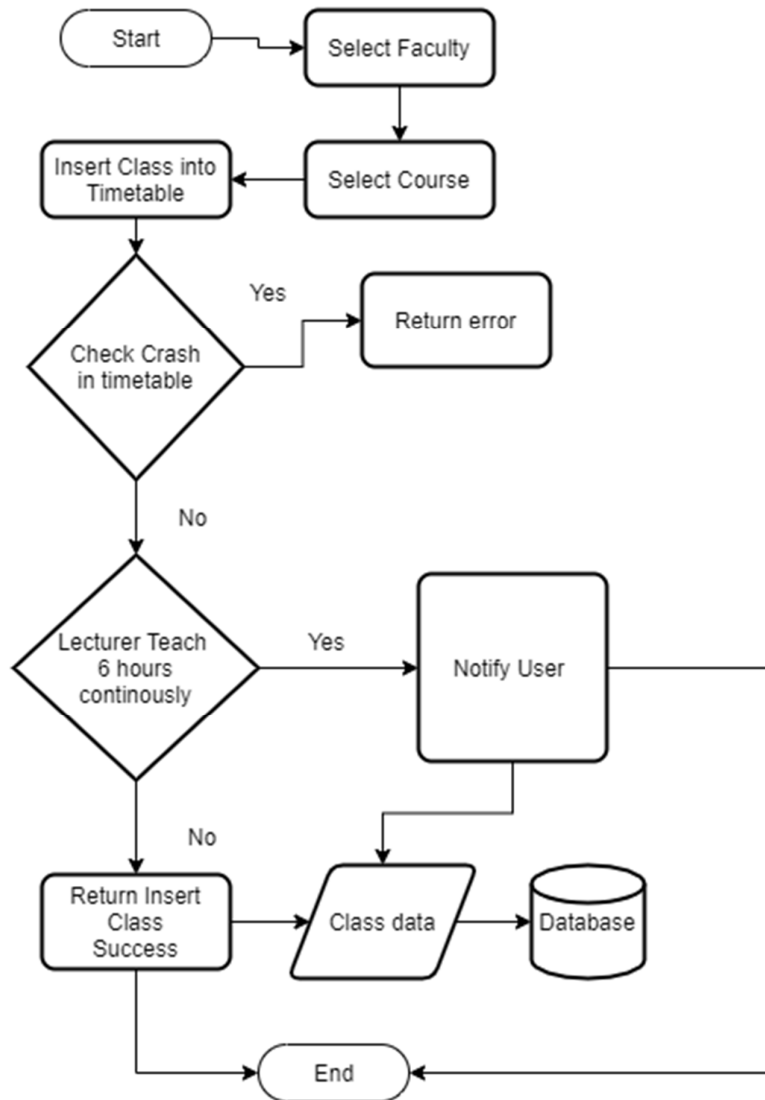


Figure 3.5: flowchart of the timetable.

3.1.4 Flowchart for Lecturer Timetable View Module

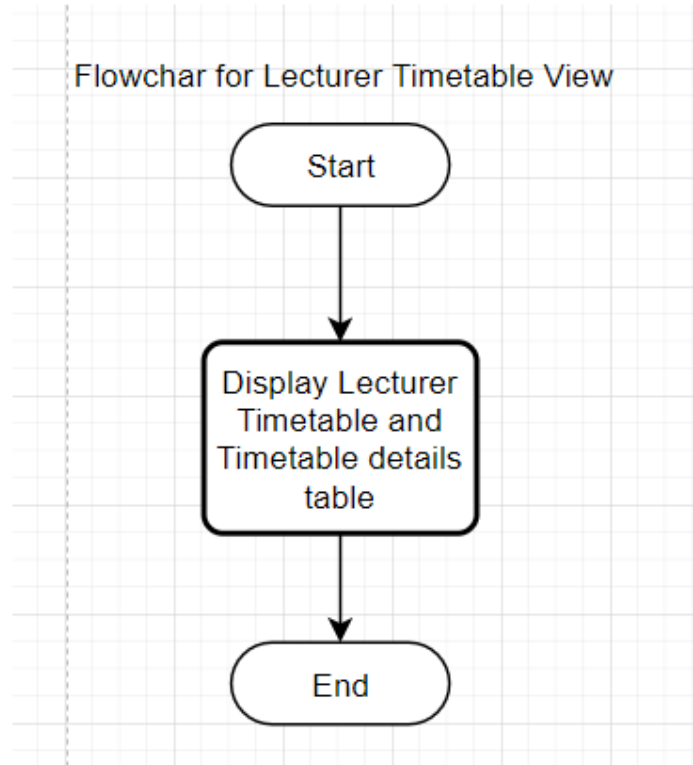


Figure 3.6: flowchart of lecturer timetable view.

3.1.5 Flowchart for Announcement Board Module

Flowchart for Announcement Board Module

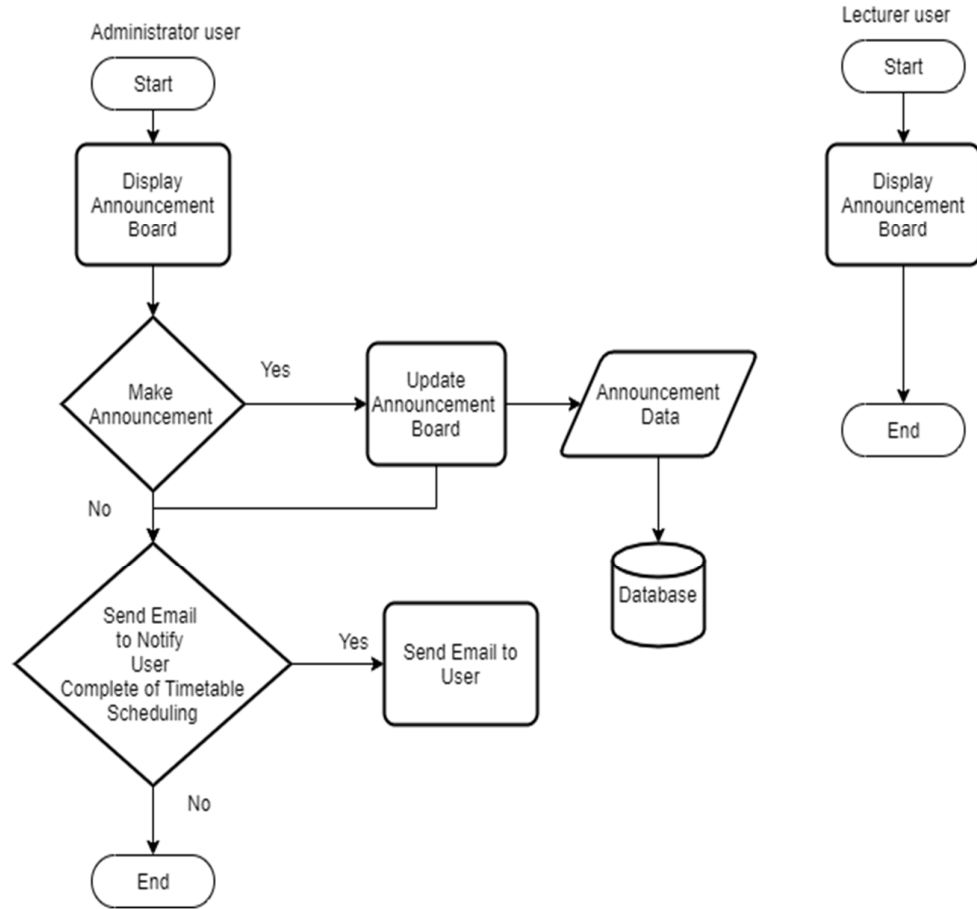


Figure 3.7: flowcharts of announcement board module.

3.1.6 Chart Module

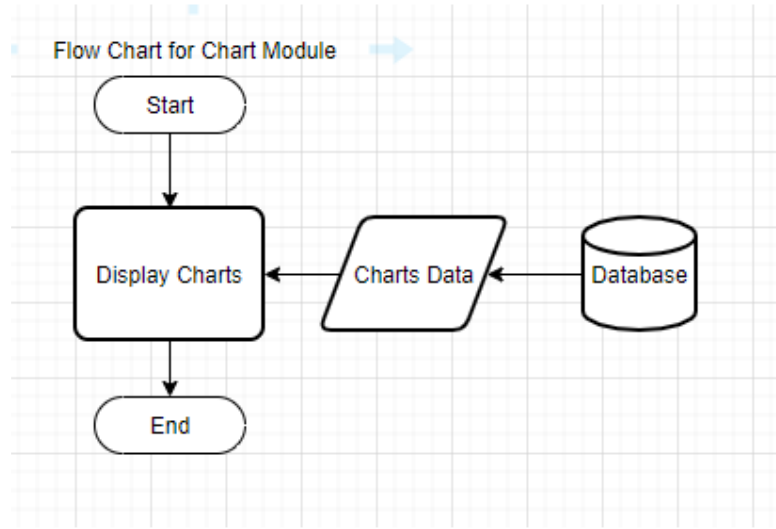


Figure 3.8: flow charts for chart module.

3.2 Use Case Diagram

Figure 3.9 show the use case diagram of this project. The purpose of use case diagram is to show how user interact with the system with different ways. In Figure 3.9, the interaction with the user are login, register, reset password, generate timetable, view timetable, add or update all the data in the system, import data into database and make announcement. If user enter wrong

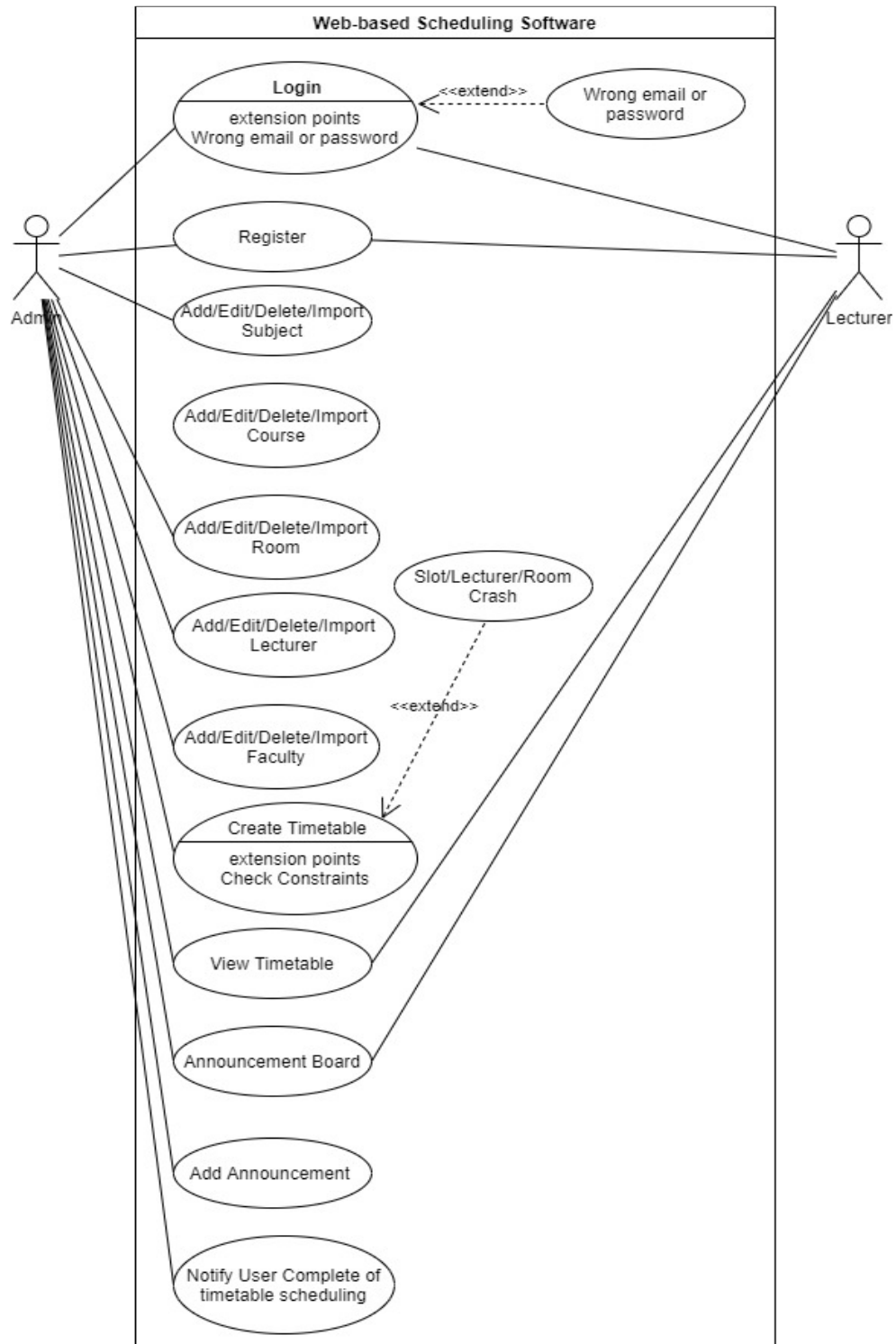


Figure 3.9: Use Case diagram of the system

3.3 Menu Design

The figure 3.10 show menu design of the website, user able to login. After login, user can add, edit, view and delete the data for the timetable. The user also can generate timetable and logout from the website. Lastly, user able to register and reset password form the website.

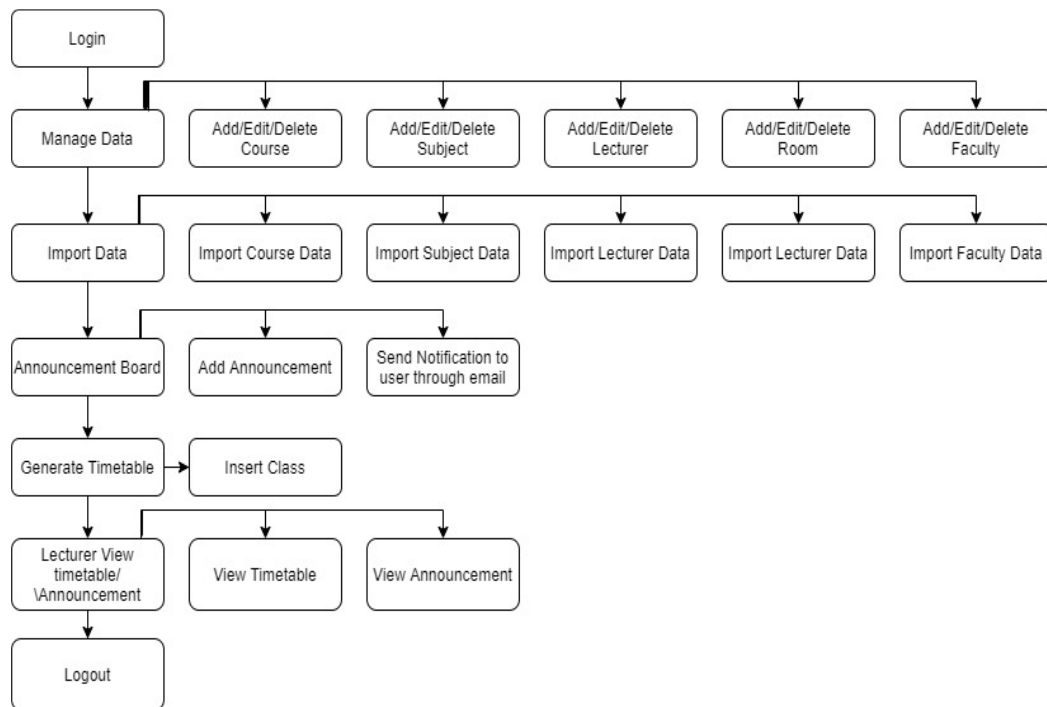


Figure 3.10: menu design of the system.

3.4 Web-based timetable scheduling software database

Figure 3.11 show database design created in MySQL. All the data for the timetable scheduling and user data will be stored in MySQL database.

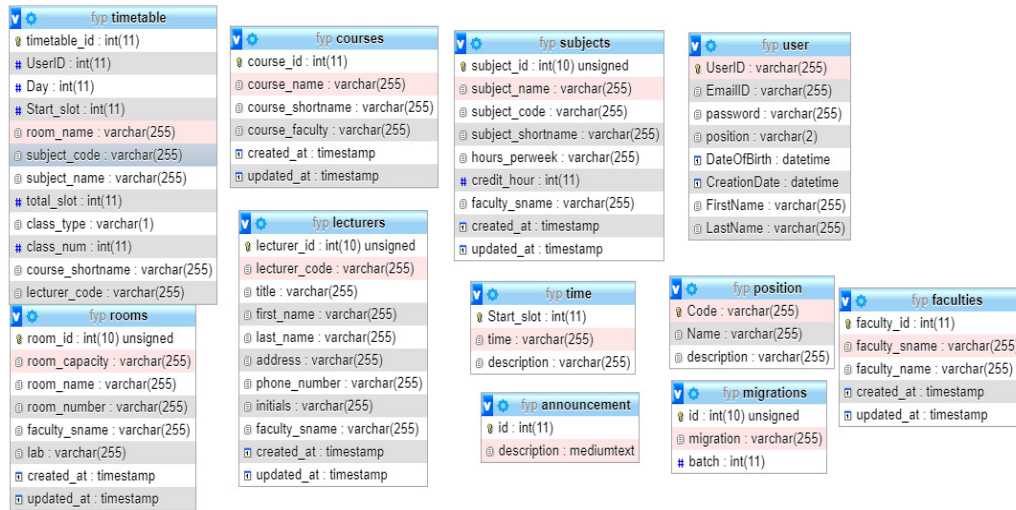


Figure 3.11: show database design

3.5 Data Dictionary

User

Column	Data Type	Description
UserID	Varchar(255)	Unique identifier ID for all user
EmailID	Varchar(255)	User Email ID
FirstName	Varchar(255)	First Name of the user
LastName	Varchar(255)	Last Name of the user
DateOfBirth	Datetime	Date of birth of the user
Password	varchar(255)	Password of the user
Position	Varchar(2)	Position of the user
Creation Date	Datetime	Time and date of data created.

Table 3.1: User table

Faculties

Column	Data Type	Description
Faculty_id	Int(11)	Unique identifier ID for faculty
Faculty_name	Varchar(255)	Name of the faculty
Faculty_sname	Varchar(255)	Short name of the faculty
Created_at	timestamp	Timestamp data created
Updated_at	timestamp	Timestamp data updated

Table 3.2: Faculties table

Courses

Column	Data Type	Description
Course_id	Int(11)	Unique identifier ID for Course
Course_name	Varchar(255)	Name of the course
Course_shortname	Varchar(255)	Short name of the course
Course_faculty	Varchar(255)	Faculty of the course
Created_at	timestamp	Timestamp data created
Updated_at	timestamp	Timestamp data updated

Table 3.3: Courses table

Lecturers

Column	Data Type	Description
Lecturer_id	Int(10)	Unique identifier ID for lecturer
Lecturer_code	Varchar(255)	Lecturer Code for lecturer
Title	Varchar(255)	Title of the lecturer
First_name	Varchar(255)	First Name of the lecturer
Last_name	Varchar(255)	Last Name of the lecturer
Address	Varchar(255)	Address of the lecturer
Phone_number	Varchar(255)	Phone Number of the lecturer
Initials	Varchar(255)	Initials of the lecturer
Faculty_sname	Varchar(255)	Short name of the faculty
Created_at	timestamp	Timestamp data created
Updated_at	timestamp	Timestamp data updated

Table 3.4: Lecturer table

Subjects

Column	Data Type	Description
Subject_id	Int(10)	Unique identifier ID for subject
Subject_name	Varchar(255)	Name of the subject
Subject_code	Varchar(255)	Code of the subject
Hours_perweek	Varchar(255)	Number of hours for the subject in a week
Subject_shortname	Varchar(255)	Short name of the subject
CreditHours	Int(11)	Credit hours of the subject
Faculty_name	Varchar(255)	Name of the faculty
Created_at	timestamp	Timestamp data created
Updated_at	timestamp	Timestamp data updated

Table 3.5: Subject table

Rooms

Column	Data Type	Description
Room_id	Int(10)	Unique identifier ID for classroom
Room_capacity	Varchar(255)	Capacity of the classroom
Room_name	Varchar(255)	Name of the room
Room_number	Varchar(255)	Number of the room
Faculty_sname	Varchar(255)	Short name of the faculty
Lab	Varchar(255)	Class is lab or not
Created_at	timestamp	Timestamp data created
Updated_at	timestamp	Timestamp data updated

Table 3.6: rooms table

Timetable

Column	Data Type	Description
Timetable_id	Int(11)	Unique identifier ID for Timetable
UserID	Int(11)	Unique identifier ID for User
Day	Int(11)	Day of the week
Start_slot	Int(11)	Slot for timetable
Room_name	Varchar(255)	Unique identifier ID for classroom
Subject_code	Varchar(255)	Code of the subject
Subject_name	Varchar(255)	Name of the subject
Total_slot	Int(11)	Total Slot of timetable
Class_type	Varchar(1)	Type of classes student attend
Class_num	Int(11)	Number of the classes
Course_shortcode	Varchar(255)	Short name of the course
Lecturer_code	Varchar(255)	Code of the lecturer

Table 3.7: Timetable table

Announcement

Column	Data Type	Description
id	Int(11)	Unique identifier ID for announcement
description	mediumtext	Description of the announcement

Table 3.8: Announcement table

Migrations

Column	Data Type	Description
Id	Int(11)	Unique identifier ID for Migrations
Migration	Varchar(255)	Details of Migrations
Batch	Int(11)	Batch of the Migrations

Table 3.9: Migrations table

Position

Column	Data Type	Description
Code	Varchar(255)	Unique identifier ID for Position
Name	Varchar(255)	Name of the position
Description	Varchar(255)	Description of the position

Table 3.10: Position table

Time

Column	Data Type	Description
Start_slot	Int(11)	Unique identifier ID for Time
Time	Varchar(255)	Time of the slot
Description	Varchar(255)	Description of the time

Table 3.11: Time table

3.4 Timeline

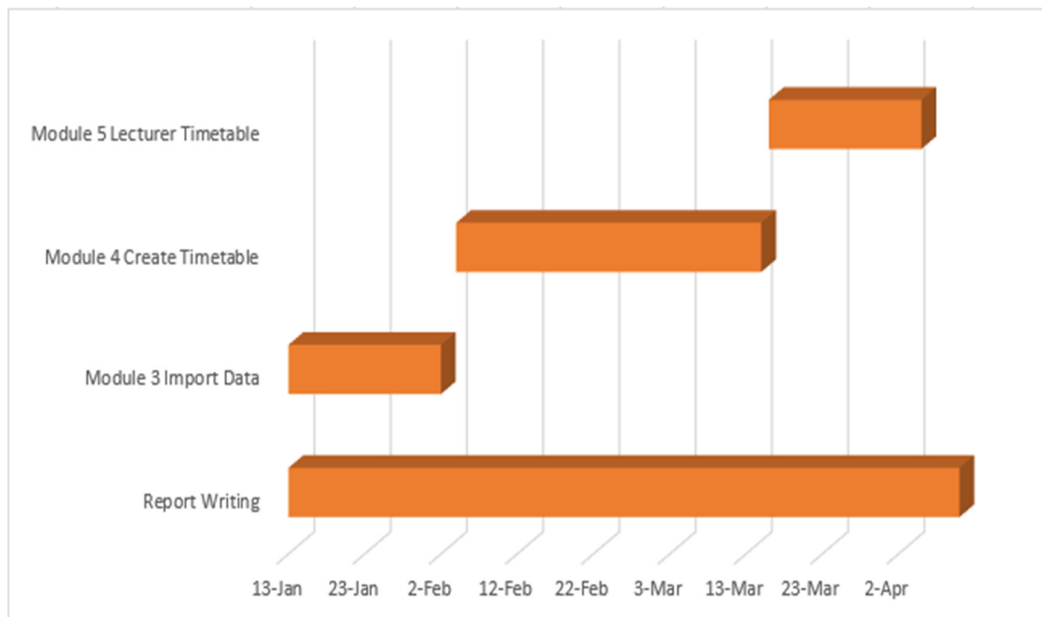


Figure 3.12: FYP2 schedule of this project.

Chapter 4 Methodologies and Tools

4.1 Methodologies

Iterative Model is a process of the software development where the development life cycle does not attempt to start with full specification of requirements. Iterative Model will start with specific and implementing one part of the project. The phase will repeat and reproduce a new version of the software in every cycle of this model.

The following is the phase of Iterative Model:

1. Requirement Analysis
2. Design
3. Implementation and Testing
4. Review Phase

There are four phases in the iterative model. First phase is requirement analysis. The requirement of the project will be identified, gathered and analysed during this phase. The iteration of this phase will eventually get a result of final specification of requirements. The second phase of the iterative model is design phase. The system will be designed based on the requirement in the first phase and every cycle will have new design or improved design of the last cycle.

Next, will be implementation and test phase. In this phase, the software is developed, integrated and tested. Lastly, the fourth phase of iterative model is review phase. In this phase, the software, software requirement will be evaluated and additional or change of requirement will be proposed.

Once all the phase is completed, decision will be made either to keep as the new starting point of the life cycle or discard the software produced. Eventually the produce will reach to the final life cycle and will be delivered.

In this project, the software will develop using iterative model and will follow the four phase as iterative model stated.

1. Requirement Analysis

In this phase, the project requirement will be identified, gathered and analysed. For example, in order to generate a crash free timetable, solving the hard and soft constraints of the timetable will be one of the requirements in the generate timetable module.

2. Design

In Design phase, the module in the project will be designed based of the requirement in phase one. For example, timetable will be designed to be able to check the crash in the timetable.

3. Implementing and Testing

In implementing and testing phase, the module will be started coding and will be tested. The generate timetable module will be tested whether it able to check the crash of the timetable.

4. Review Phase

In review phase, the module will be either keep as a new starting point for new cycle or discard. For example, if keep the developed timetable module, the module will set as starting point of the next life cycle module with another new requirement. The new life cycle might be solving new requirement such as another hard constraints or soft constraints that need to overcome to generate a crash free timetable.

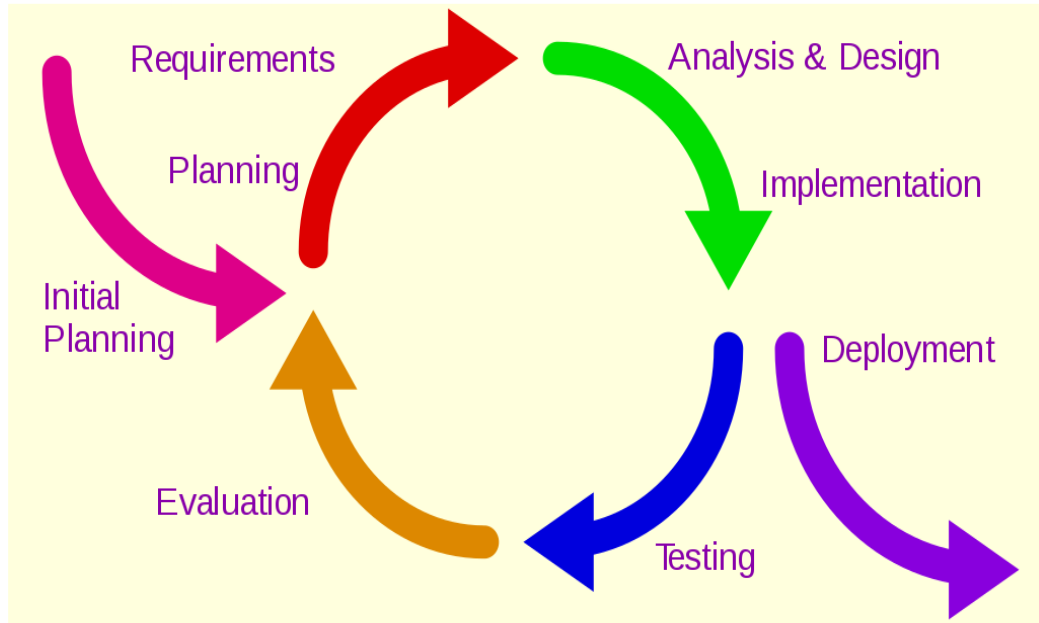


Figure 4.1: phase Iterative model.

4.2 Technology Used

PHP language is used as the language to develop this project software. PHP is a server-side scripting language. PHP allow user to develop a static website or dynamic website or a web application. PHP has been created by Rasmus Lerdorf back in 1994. PHP is used to manage database, dynamic content, session tracking even develops an e-commerce website. The reason why PHP is chosen in this project is because it is more dynamic compare to ASP.net. there are less restriction in PHP language and it is open source scripting language which is fairly easy to learn and apply in application.

Next, MySQL will be used in as database management to manage the database in this software. MySQL is an open source relational database management system which released in 1995. MySQL is a client-server model based database management system. MySQL server will handle all the database instructions and MySQL client send all the commands made by users in the computer and it work with numbers of utility program which support MySQL database administration.

After that, Microsoft visual studio code is a source code editor that variety of programming language can be used on this editor. Visual studio code was created by Microsoft in 2015. Programming language such as C++, PHP and java can be written in this source code editor. It is based on Electron framework. It allows user to open multiple directories at the same time and it provide different features to different programming language. In this project, The PHP code will be written in Visual studio code.

Lastly, composer is used as a tool for dependency management in PHP. It allows php project to declare the necessary libraries project depends on and manage those libraries. Composer is used in this project to create a Laravel framework php project and install necessary package such as maatwebsite/excel for import data use.

4.3 User Requirement

There are numbers of software needed to be installed in the computer before can run the application. Below is the list of software required:

- I. Visual Studio Code
- II. Xampp
- III. MySQL
- IV. Composer

4.4 Implementation Issues and Challenge

In the progress of the project, it is natural that some issues and challenged needed to overcome and solved. There are several issues and challenges faced during the implementation of the project. First challenge would be understanding the process of generating a timetable. It is rarely for a student to perform a timetable scheduling. Therefore, everything is started from bottom from understanding the timetable, understanding hard and soft constraints to finally able to insert a class into timetable. During this process, there are many problems have been encounters such as implementing hard constraints and soft constraints in timetable. Fortunately, the problems were able to be solve during the process.

Next, using Laravel framework also causes few problems during developing the prototype. Due to the package needed is older version, the newer Laravel framework did not support the older version package and causes the need to find another package or need to learn the new version package that cause using more time to develop a module.

Chapter 5 System Implementation and Testing

5.1 Manage Data Module

The manage data module able to let user to manage data for course data, lecturer data, subject data, room data and faculty data. These data are the most important things in the project. Without these data, the timetable will not able to generated. User able to perform create data, edit data, and delete data in this module.

Figure 5.1 show the main page of the Faculty data. Administrator user able to see all the data in the main page and user able to perform create new faculty data, edit faculty data, and delete faculty data.

Faculty Data

[Add Data](#)

Show entries Search:

User ID	Short Name	Name	Action
1	FICT	Faculty of Information and Communication Technology	Edit Delete
2	FBF	Faculty of Business and Finance	Edit Delete
3	FCI	Faculty of Creative Industries	Edit Delete
4	FEGT	Faculty of Engineering & Green Technology	Edit Delete

Showing 1 to 4 of 4 entries Previous **1** Next

Figure 5.1: Main page for faculty data.

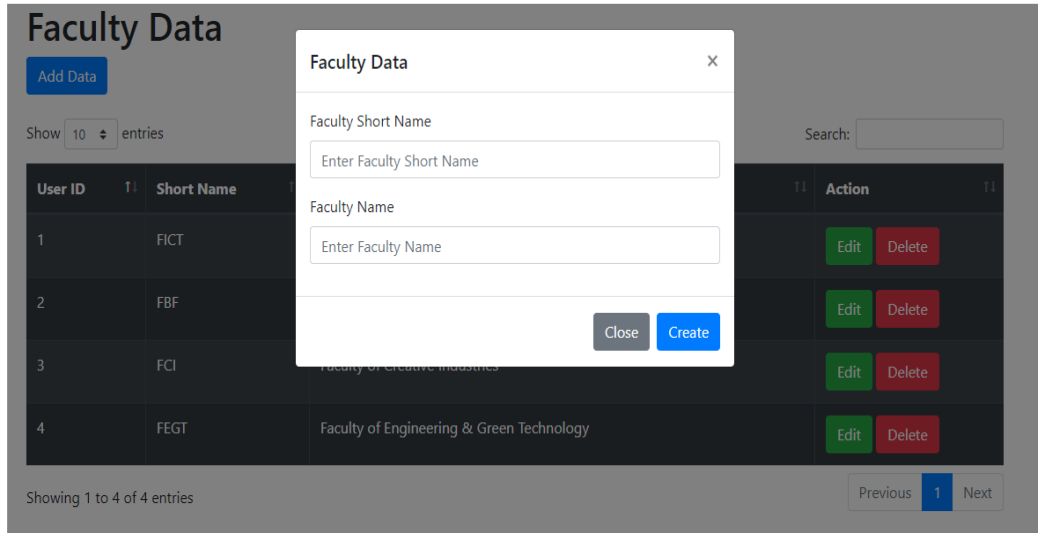


Figure 5.2: Add new data for faculty data.

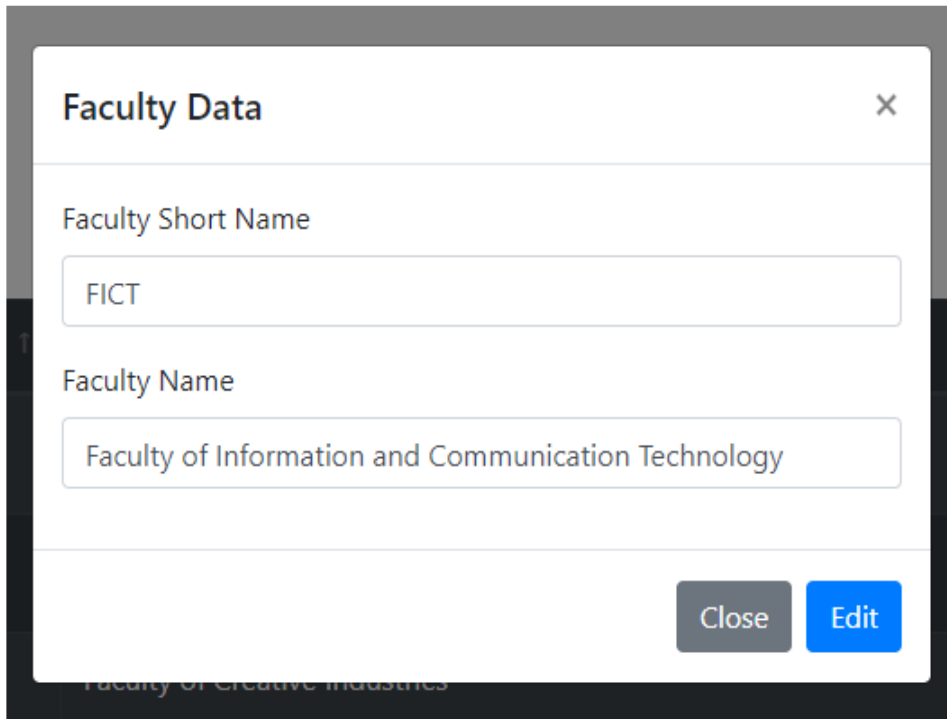


Figure 5.3: Edit specific data for faculty data.

5.1.1 Test Methods

Test Items	Test Input	Expected Output
Add Data	Faculty Short Name: FAS Faculty Name:	Prompt error: Faculty Name is required.
Add Data	Faculty Short Name: FAS Faculty Name: Faculty of Arts and Social Science	Prompt success: Data Saved.
Edit Data	Edit Faculty Short Name of FAS to FICT	Data Updated
Edit Data	Leave Blank in Edit Faculty Short Name	Field faculty short name is required.
Delete Data	Delete Data	Prompt success: Delete Success.

Table 5.1: show test method for manage data module.

5.2 Import Data Module

Import data module able to let user import and export data form excel .xlsx file to the database in MySQL database. Figure 5.4 show Test data file in excel, user can choose file in the computer and submit on the page, this module will run and insert .xlsx file into database so the table list will refresh will new data.

Import Faculty Data

Choose file Browse Import Export

ID	Faculty Short Name	Faculty Name
1	FICT	Faculty of Information and Communication Technology
2	FBF	Faculty of Business and Finance
3	FCI	Faculty of Creative Industries
4	FEGT	Faculty of Engineering & Green Technology

Figure 5.4: Interface of import data and export module

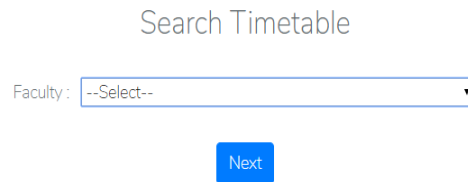
5.2.1 Test Methods

Test Items	Test Input/Output	Expected Output
Import Data	Xlsx file	Table refreshed with new data.
Import Data	-	Page will prompt required file
Export Data	Xlsx file	Faculty Data has been downloaded in Xlsx file.

Table 5.2 show test method for import data module

5.3 Generate timetable Module

In generate timetable module, user will insert classes into timetable. When user insert classes into timetable, system will check the constraints in the timetable. If there are no constraints, the classes will successfully be added into timetable. If there is a crash in the timetable, the system will notify user with error. User able to delete the classes if they feel not suitable on the details table.



Search Timetable

Faculty: --Select--

Next

Figure 5.5: select faculty of the timetable.

Search Timetable

Course :

Next

Figure 5.6: select course of the timetable.

successfully added

Timetable Scheduling

Day/Time	07:00	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00
	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00
Mon	UCCD2233 LDK1(1)(P)	UCCD2233 LDK3(1)(L)							UCCD2233 LDK1(3)(P)			
Tue										UCCD2233 LDK1(2)(P)		
Wed											UCCD2233 N004(1)(P)	
Thu									UCCD2233 LDK1(1)(P)			
Fri										UCCD2233 LDK1(3)(L)		

User ID

Room

Subject Code

Subject Name

Course

Figure 5.7: classes insert successfully.

Slot 5 has been allocated

Room has been allocated

Lecturer having another class during this time

Lecturer having another class during this time

Timetable Scheduling

Day/Time	07:00	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00
	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00
Mon	UCCD2233 LDK1(2)(L)	UCCD2233 LDK3(1)(L)	UCCD2233 LDK1(1)(L)	UCCD2233 LDK1(2)(P)	UCCD2233 LDK1(1)(L)	UCCD2233 LDK1(3)(P)						
Tue										UCCD2233 LDK1(2)(P)		

Figure 5.8: system return error to add classes due to crash of timetable.

successfully added, Note: Lecturer 1503806 will be teaching six hours continuously

Timetable Scheduling

Day/Time	07:00	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00
	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00
Mon	UCCD2233 LDK1(2)(L)	UCCD2233 LDK3(1)(L)	UCCD2233 LDK1(1)(L)	UCCD2233 LDK1(2)(P)	UCCD2233 LDK1(2)(P)				UCCD2233 LDK1(3)(P)			
Tue										UCCD2233 LDK1(2)(P)		
Wed											UCCD2233 N004(1)(P)	
Thu									UCCD2233 LDK1(1)(P)			
Fri										UCCD2233 LDK1(3)(L)		

User ID

Room

Subject Code

Subject Name

Course

Figure 5.9: soft constraints of the timetable.

5.3.1 Test Methods

Test Items	Test Input/Output	Expected Output
Insert Class	User ID: 1503806 Room: LDK1 Subject Code and Name: UCCD2233 Database Administration Course: IA Lecturer: 1503806 Day: Friday Time: 8am Duration: 1 hours Class type: L Class Group: 1	Prompt message: successful added to user.
Insert Class	User ID: 1503806 Room: LDK1 Subject Code and Name: UCCD2233 Database Administration Course: IA Lecturer: 1503806	Page will prompt message: Time slot allocated, Lecturer having class now and Room allocated

	<p>Day: Friday</p> <p>Time: 8am</p> <p>Duration: 1 hours</p> <p>Class type: L</p> <p>Class Group: 1</p>	
Insert Class	<p>User ID: 1603121</p> <p>Room: LDK1</p> <p>Subject Code and Name: UCCD2233 Database Adminstration</p> <p>Course: IA</p> <p>Lecturer: 1603121</p> <p>Day: Friday</p> <p>Time: 8am</p> <p>Duration: 1 hours</p> <p>Class type: L</p> <p>Class Group: 1</p>	<p>Prompt message: Time slot allocated and Room allocated</p>

Table 5.3 show test method for generate timetable

5.4 Lecturer Timetable View Module

In Lecturer Timetable View module, lecturer user able to look at the classes they will be teaching in the timetable. Next, user able to check the classes details in the details table and user able to sort the details table by day, description, unit, course or start time.

Timetable

Day/Time	07:00	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00
	08:00	09:00	10:00	11:00	12:00	01:00	02:00	03:00	04:00	05:00	06:00	07:00
Mon	UCCD2233 LDK1(2)(L)		UCCD2233 LDK3(1)(L)						UCCD2233 LDK1(3)(P)			
Tue										UCCD2233 LDK1(2)(P)		
Wed											UCCD2233 N004(1)(P)	
Thu									UCCD2233 LDK1(1)(P)			
Fri										UCCD2233 LDK1(3)(L)		

Show 10 entries

Search:

Unit	Description	Type	Class Group	Course	Day	Start Time	End Time
UCCD2233	Database Administration	L	3	IA	Friday	4 PM.	5 PM.
UCCD2233	Database Administration	L	1	IA	Monday	8 AM.	9 AM.
UCCD2233	Database Administration	P	3	IA	Monday	3 PM.	4 PM.
UCCD2233	Database Administration	L	2	IA	Monday	7 AM	8 AM.
UCCD2233	Database Administration	P	1	IA	Thursday	3 PM.	5 PM.
UCCD2233	Database Administration	P	2	IA	Tuesday	4 PM.	5.30 PM.
UCCD2233	Database Administration	P	1	IA	Wednesday	5 PM.	6 PM.

Figure 5.10: lecturer user timetable and sort detail table by day.

5.5 Announcement Board Module

In Announcement board module, administrator user can send notification to all user by email and also add new announcement into announcement board. Lecturer user able to view the announcement on lecturer announcement board and receive email from administrator user. This module created for better communication between the users.

Announcement Board

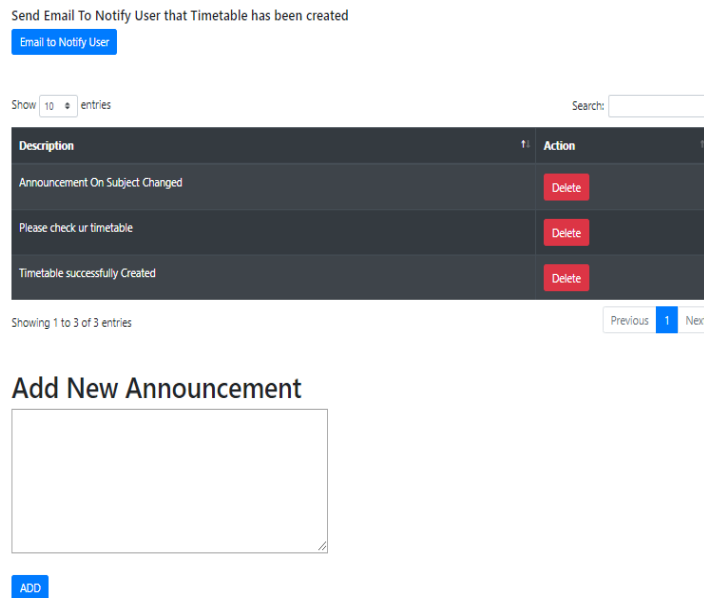


Figure 5.11: announcement board of admin user.

Announcement Board

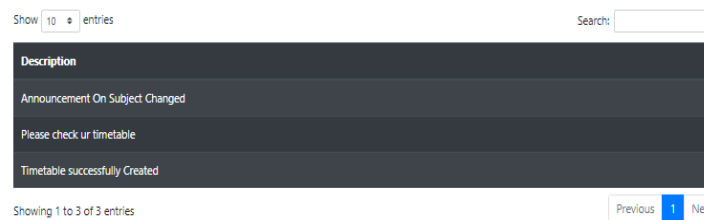


Figure 5.12: announcement board of lecturer user.

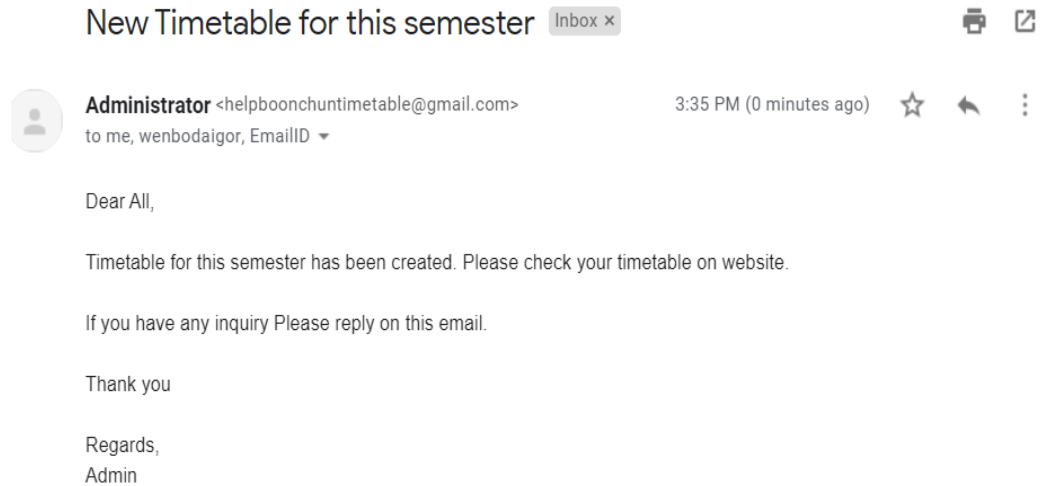


Figure 5.13: email sent to the lecturer user.

5.5.1 Test Methods

Test Items	Test Input/Output	Expected Output
Add new announcement	Testing	Message Prompt to user : Announcement has been publish
Delete Announcement	Delete	Announcement Deleted
Email to Notify user	Select Email to notify user	User receive email

Table 5.4 show test method of announcement board module

5.6 Chart Module

In this module, three charts are included in a page for user to understand the data and the relationships between parts of the data. User able to see the difference of total subject in each faculty, total course in each faculty and totally lecturer in each faculty.

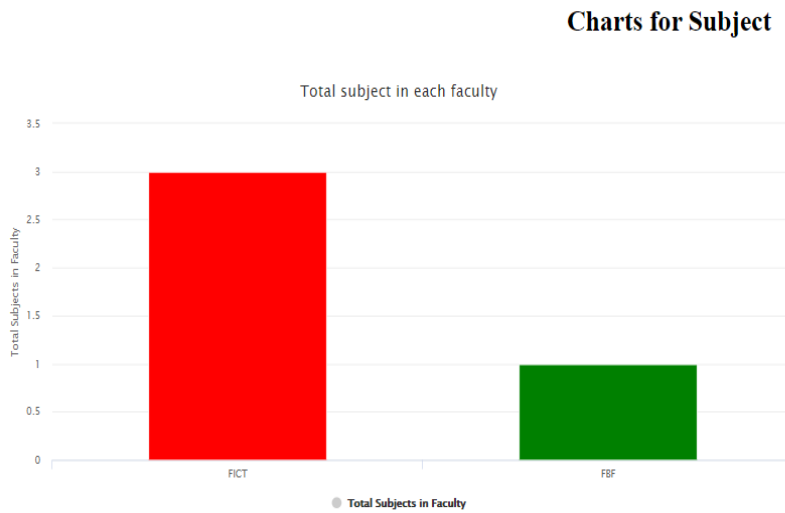


Figure 5.14: charts for total subject in each faculty.

Chapter 6 Conclusion

6.1 Conclusion

As a conclusion, proposed web-based timetable scheduling software able to let user to generate a crash free timetable that overcome hard constraints in the timetable. With this, user able to improve their reduce time and increase efficiency to generate a timetable. Data import and export module able to help reduce time user insert data into database and provide convenience to user by exporting the all the data into xlsx file. This project also includes lecturer timetable view module for lecturer user to view their timetable and class details in real time. Next, the include of announcement board able to improve communication between lecturer user and administrator user.

The end product of this project has achieved the objective stated which are solved the hard constraints and soft constraints in the timetable scheduling. Achieving this objective allow user to generate a crash free timetable. Next, including module such as chart module and announcement board module able to provide better user experience to user. throughout this project, the necessary module is found such as import data module that able to help improve the user experience and reduce working time and working efficiency of user.

After that, there are some problems encountered throughout the project. One of the problems is that the lack of support of older version package in the Laravel framework. It causes to take more time to find another package that have similar features to use in the project. Next, solving the hard constraints and solve constraints in timetable is another challenge in this project. The lack of knowledge on timetable scheduling cause needed of extra time to solve the problems.

6.2 Contribution of the project

Contributions of this project are this project able to reduce the time and workload of user to scheduling a timetable. For example, import data module that insert data from excel file to database reduce user insert data time. It also provides more user-friendly software to user such as it able to let user generate timetable and check timetable based on course. It also provides better user experience to user such as better sorting in timetable details table. The announcement board module able to improve communication between lecturer and staff and lecturer able to view their timetable with a good sorting to the class details table in the timetable.

6.3 Future Improvement

- Automatic Generate Timetable

In this project, the timetable is done manually which is insert class one by one and check constraints. With include the automatic generate timetable, it able to reduce huge amount of time and improve working efficiency for user to generate timetable.

- Include Student User into software

As this project only have administrator user and lecturer user, include of student user will improve the project. However, there is need of concern of some institution use course bidding system for their student.

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Poster

WEB-BASED SCHEDULING SOFTWARE FOR A UNIVERSITY

INTRODUCTION

Timetable scheduling is a complex task that need to solve my university management every semester. propose a web-based scheduling software which would improve the efficiency and productivity of the management.

PROBLEM STATEMENT OF TIMETABLE SCHEDULING

University that do not use software to generate timetable automatically will cost a lot of time and decrease the productivity and efficiency of management.

While the University management that use the timetable scheduling software, some of them do not have import data functional for university management to import their data. This cause university management need to key in data one by one and it take a lot of time.

Lastly, generating timetable software without conflict and constraints is hard. In order to do a crash free timetable, management need to take a lot of time just to do a timetable.

SOLUTION OF THE PROBLEM

A Web-based scheduling software that will solve the hard constraints and soft constraints. The software also provide function such as Announcement Board that improve communication between Lecturer and Administrator.

MOTIVATION

The motivation of this project is to give convenience to user.

OBJECTIVE

- 1) Develop a software that overcome soft constraints and hard constraints.
- 2) Develop a scheduling software that include new features to give better user experience for user.
- 3) Identify necessary module for timetable scheduling.

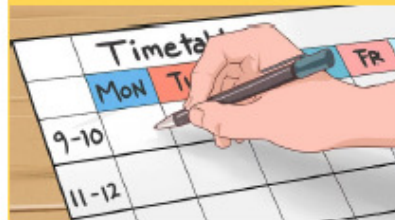


Figure 7.1: poster of this project.

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Chapter 1 Introduction
1.1 Problem Statement

Scheduling timetable in university is a complex task that involves on what subject student take, lecturer availability and venue requirement. Given that there is a set of lecturers, set of class, set of rooms and hours of lecture in 1 week. Usually, timetable is created manually and it can be a very time-consuming task and frustrating for the teachers (Fedena Blog, 2018). Web-based scheduling software need to solve these conditions in order to generate crash free timetable that can help user to optimize the university resources perfectly.

After that, Scheduling software need to able to import data from university to get all students, lecturers and other data to generate a timetable that suit university. Manually insert the data will cost management of university a lot of time because there are thousands of teachers, rooms and hundreds of subject to insert.

Next, every university timetable will include a table that contains details of the classes such

Match Overview

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Figure 8.1: Turnitin report.

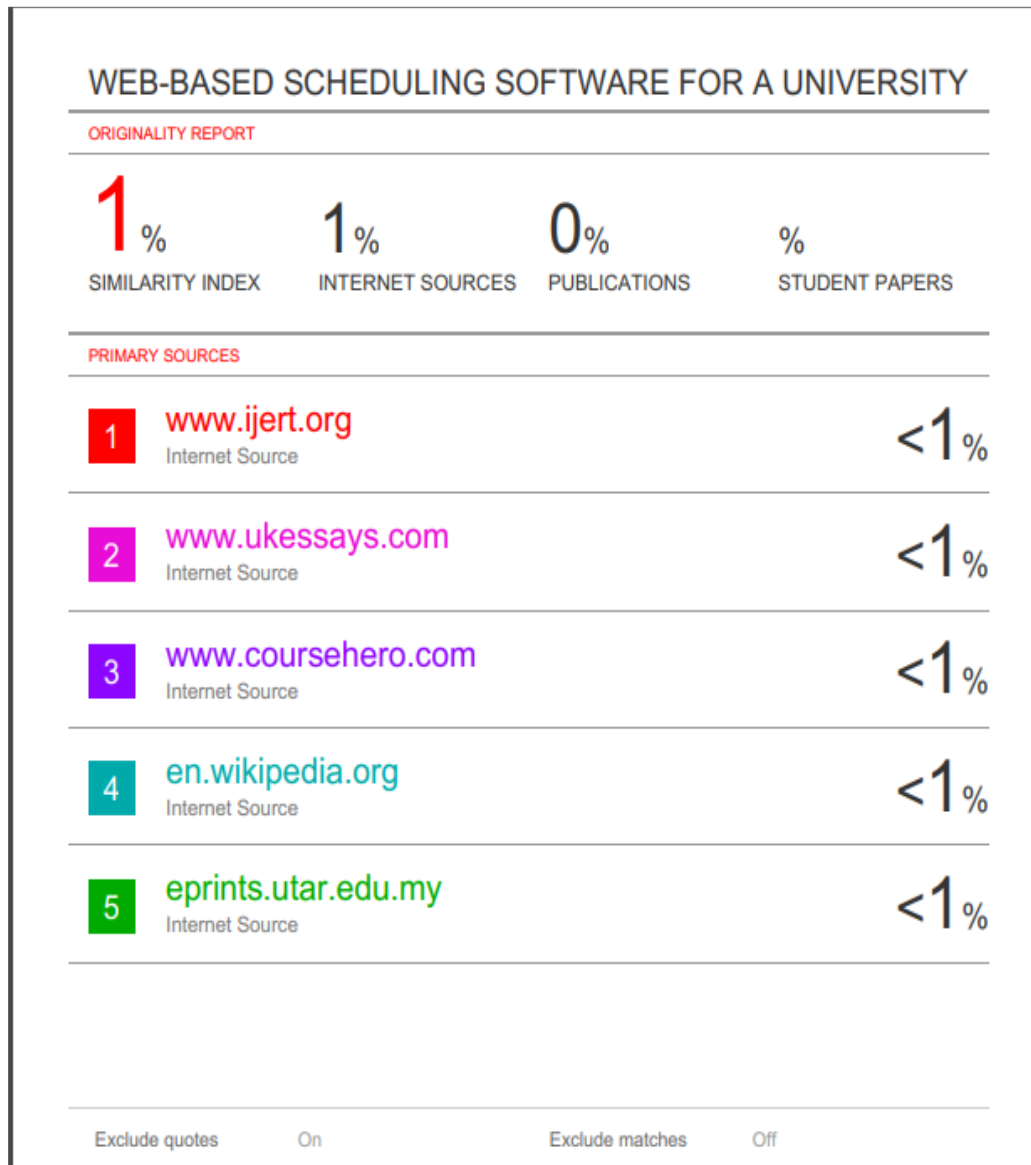


Figure 8.2: Turnitin report.

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Similarity	Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)
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Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

Signature of Supervisor

Name: Ts Chan Lee Kwun

Date: 23/4/2020

Signature of Co-Supervisor

Name: _____

Date: _____



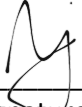

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