DESIGNING CLASS SCHEDULE INFORMATION SYSTEM BY USING TABOO-SEARCH METHOD

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Abstract—Drafting of class schedule at the Faculty of Information and Communication Technology, Mataram University of Technology (FTIK UTM) is still done manually. So that, there are some problems such as lecturer teaching schedule at the same time at one time as well as student learning time at the same time at one time and studying more than 3 times a day. Therefore, manual scheduling requires a lot of time and it must be done very carefully. The method used to solve this problem is the Taboo- Search Method which is used to solve the problem of scheduling. The Taboo-Search Method is a method that seeks the best solution from existing solutions by creating a list of solutions or taboo lists, solutions that have been used previously will no longer be displayed for the next problem. The research method used in this research is the method of research and research and development which starts from the preliminary stage to find problems that occur up to the implementation stage so that it is generated an information system of course schedule at the Faculty of Information and Communication Technology, Mataram University of Technology. The purpose of this research is to produce a class schedule information system so that it can help arrange class schedules more quickly and precisely.

Keywords: Information Systems, Lecture Schedule Information Systems, Taboo Search Method.

Abstrak—*Penyusunan jadwal kuliah pada Fakultas Teknologi Infomasi dan Komunikasi Universitas Teknologi Mataram (FTIK UTM Mataram) masih dilakukan dengan cara manual sehingga terdapat beberapa permasalahan seperti jadwal mengajar dosen dalam jam yang sama pada satu waktu serta jam belajar mahasiswa pada jam yang sama pada satu waktu dan belajar lebih dari 3 kali dalam sehari. Oleh karena itu, penyusunan jadwal secara manual membutuhkan waktu yang cukup lama serta keteletian yang tinggi. Metode yang digunakan untuk menyelesaikan permasalahan ini adalah metode Tabu Search yang digunakan untuk menyelesaikan masalah penyusunan jadwal. Metode Tabu Search adalah metode yang mencari solusi terbaik dari solusi yang ada dengan cara membuat list solusi atau tabu list, solusi yang sudah digunakan sebelumnya tidak akan ditampilkan lagi untuk permasalahan berikutnya. Metode penelitian yang digunakan dalam penelitian ini adalah metode penelitian dan pengembangan Research and development yang dimulai dari tahap pendahuluan untuk menemukan permasalahan yang terjadi sampai dengan tahap implementasi sehingga dihasilkan sebuah sistem informasi jadwal kuliah pada Fakultas Teknologi Infomasi dan Komunikasi Universitas Teknologi Mataram. Tujuan dari penelitian ini adalah menghasilkan sistem informasi jadwal kuliah sehingga dapat membantu bagian akademik menyusun jadwal kuliah dengan lebih cepat dan tepat.*

Kata Kunci*: Sistem Informasi, Sistem Informasi Jadwal Kuliah , Metode Tabu Search*

INTRODUCTION

Scheduling is an activity that is carried out in various activities and uses various types of methods. Activities carried out to allocate existing resources are called scheduling activities (Trisnawati, Ade, BM Sangadji, Iriansyah, Karmila, 2011). One of the activities that must use scheduling is lecture activities at the Faculty of Information and Communication Technology, Mataram University of Technology. From the results of observations carried out at the Faculty of Information and Communication Technology, the Mataram University of Technology, preparation of class schedules which is done by the administration takes a long time to produce a proper schedule. In compiling the class schedule the variables needed are courses, credits, time, class, room, and lecturers, as well as teaching days. The problem that often occurs in drafting class schedules is that there are often clashes in teaching times (Anamisa & Djunaidy, 2014), (Handayani S., Rosely, & Mayadewi, 2016) such as teaching at the

same time in different rooms. Another problem is that students take 2 courses at the same time (Daswa & Riyadi, 2017), as well as requests from lecturers to teach on certain days and times. This happens because the scheduling is still done manually (Adnyana, 2017), (Rosmasari, 2019) by listing all existing courses and the number of lecturers and the number of classes available at Faculty of Information and Communication Technology, Mataram University of Technology. Schedule arrangement also requires accuracy and long processing time. This schedule will also be more difficult when the number of classes in each generation continues to increase. Therefore we need a lecture scheduling information system and use the right method in providing solutions to each problem.

The most appropriate solution to this problem is to create a class schedule information system that can help the administration to prepare class schedules at the Faculty of Information and Communication Technology, Mataram University of Technology. The innovation of the old system is making a schedule from a manual system to an information system that is ready to be run and using the right method that is the Taboo-Search Method. The Taboo-Search Method (Zhao, Ji, Guo, Du, & Wang, 2019) is a heuristic method that is generally used to find near-optimal solutions to a problem by moving, carrying out the search process and moving from one solution to the next (Miswanto, Pernando, & Aditya Firmansyah, 2018). The Taboo-Search Method is a method that looks for the best solution from existing solutions by creating a list of solutions or taboo lists, solutions that have been used previously will no longer be displayed for the next problem.

Research on this schedule information system has been conducted previously by several researchers. One of the studies that discuss the schedule information system is a study entitled "Design scheduling information system Higher Education Resources Using Particle Swarm Optimization (PSO) Method "in 2014 it discusses the creating of a lecture scheduling information system using the PSO method. The weakness of this research is that there are still conflicts in the test results so that it is not optimal in providing solutions (Mansur, 2014).

Another research that discusses the scheduling system is the research entitled "Design a Learning Schedule System Using Graph Coloring" which was held in 2015, discussed the learning scheduling problems that schools often face in the new school year. So that a scheduling information system is created using graph coloring, however, the appearance of the program is not attractive and makes it difficult for users and features that need to be added to improve the program (Hidayatulloh, 2015).

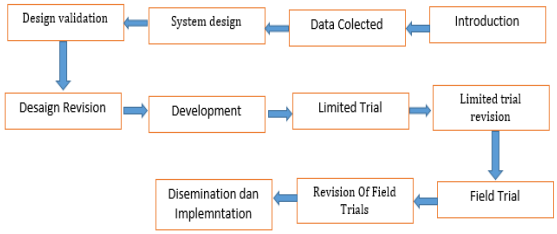
Another study entitled "Lecture Scheduling Information System (Case Study: State Islamic Institute (Iain) Imam Bonjol Padang" which was conducted in 2014 discussed the creation of a lecture schedule information system at IAIN Imam Bonjol Padang using the VB programming language while in this study will be created using the PHP programming language (Asmara, 2014).

Another research that follows is a study entitled "Search for the Fastest Route Search for Travel Routes with the Taboo Search Algorithm" which was carried out in 2013 discusses the main problem for tourists, both domestic and foreign tourists, is the tourist route they must take, this is due to There are a lot of tourist objects and alternative routes, however, this research implements the taboo search method in preparing the class schedule (Varita et al., 2013)

Many previous studies have made schedule information systems, but using different methods. Some have made the same method but the information system created is still desktop-based. Therefore, in this research, the innovation is that this research is carried out using the taboo search method which will be implemented in a web-based lecture schedule information system so that administrative staff can input schedules from anywhere and students and lecturers can check teaching schedules anytime and anywhere. Entering the schedule using this information system will make it easier for administrative staff and speed up making class schedules because it has been set directly by the system. The purpose of this research is to produce a class schedule information system so that it can help arrange class schedules more quickly and precisely.

MATERIALS AND METHODS

The research method used is the method of research and development (Research and Development). The research and Development (R&D) method according to Sugiyono is a research method used to make products and test the effectiveness of these products (Sugiyono, 2015). In this Research and Development (R&D) Method, the steps of the research carried out include can be seen in Figure 1.



Source : (Sugiyono, 2015)

Figure1. R&D

1. Introduction
   The preliminary stage is the stage of finding potential and problems that occur. Potential is defined as anything that if someone uses it, it will have additional value, while the problem is a deviation between what is expected and what happened. At this stage, the potential that is possessed is the administration staff in determining class schedules at a college. The problem raised is how to make a lecture schedule system that can help administrative staff in making the right schedule at the college according to the number of lecturers and students and their courses.
2. Data Collection Stage
   The data collection stage was carried out through literature study and information gathering. Literature studies are carried out by examining various concepts, methods, and system applications based on theories from books related to the problems studied and previous research journals. Information gathering is also carried out through interviews with parties related to the issues raised in this case all Heads of Study Program FTIK UTM Mataram and administrative staff are in charge of inputting class schedules. Also, direct observations were made at the research location that is FTIK UTM Mataram.
3. Design/system design
   At this stage, the researchers conducted a system analysis such as an analysis of the use of the Taboo-Search Algorithm and system requirements analysis. Also, at the design stage/system design includes the design stage using UML. The system design is based on the results of interviews and observations.
4. Design validation.
   Design validation is an activation process to assess whether the system design made in this case the new system will be more effective than the existing conventional system.
5. Revised design.
   The design revision stage is the stage of making improvements to the design or system design on the results of the design validation of the system analysis and design experts. Designs that are not yet valid due to deficiencies will be corrected until they are declared valid and feasible by experts.
6. Development
   The stage of making the system is the stage of making an application. This stage is the longest in this research because it is related to typing the source code for each page, both input, process, and output. Making a schedule information system using the taboo search method to determine the most appropriate schedule.
7. Limited trial.
   At this stage, a sample user who is accompanied by a team of programmers will simulate the use of the system. This is done to find out whether all the features in the system are running well or there are no syntax errors during the test.
8. Revision of the first product
   This stage includes system repairs, which are based on limited testing if any features or syntax errors are found.
9. Field trials
   This stage is the stage of testing the use of all system users before it is implemented. The user of this information system is the Administration Staff at FTIK UTM Mataram.
10. Second Product Revision
    This stage is the final revision stage before implementation. Revisions are made based on input or suggestions from users who have tested the use of the system.
11. Dissemination and Implementation.
    The implementation stage is the stage of using the system in actual conditions when making a schedule when lectures will begin at the beginning of each semester at FTIK UTM Mataram.

RESULTS AND DISCUSSION

By the stages in the Research and development method, the results and discussion of each stage are as follows

1. Introduction

The preliminary stage discusses the potential and problems faced by users, namely the preparation of ineffective lecture schedules. Therefore, the solution offered is in the form of a lecture schedule information system using the taboo search method.

2. Data Collection Stage

Methods of data collection are done through observation and interviews. Observations were made at UTM Mataram while interviews were carried out with an administrative staff of UTM

FTIK who would be users of the system to be created.

3. Design

a. System Requirements Analysis

The software needed to run this system is Windows 10, Xampp (Apache and MySQL), Visual Studio Code, Navicat Premium, Mozilla Firefox, and Google Chrome. While the hardware needed for the schedule information system is as follows: Laptop / Computer, Minimum Intel 2 Core CPU Up to 2.4GHz, Minimum 2GB Ram, and Minimum 50GB Hard Drive.

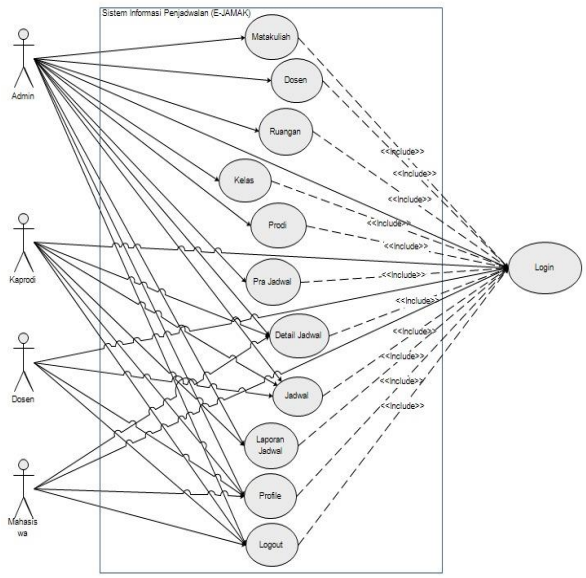
b. Designing a taboo search algorithm

Admin inputs data into the system, namely lecturer data, course data, room data, study program data, and class data. The input data is stored in the database. Next, determine the day, hour, course, lecturer, room, and class on one schedule. The first schedule was made as an initial solution. Next, look for the conflict value to be included in the taboo list to carry out the next iteration that is repeated until the conflict value=0.

c. System Design Using UML

1) Use Case Diagram

Use Case Diagram is used to describe what a system is doing and describe the interaction between actors and the system. The Lecture Schedule Information System consists of four actors, such as; admin, lecturer, head of the study program, and students who have different access rights to the system. The admin can access all menus in the system while the head of the study program, lecturers, and students can only access certain menus. Use Case Diagram of the schedule information system can be seen in Figure 2.

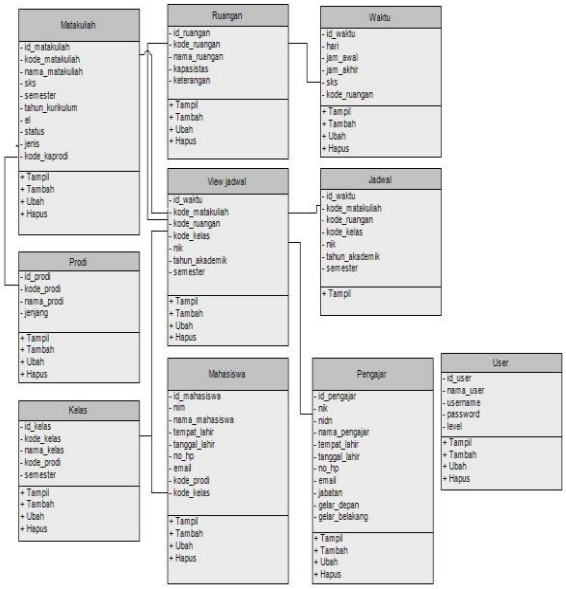


Source: (Zaeniah & Salman, 2020)

Figure 2. Use Case Diagram

2) Class Diagram

A class diagram is used to describe the relationship between one class and another. The class diagram for the schedule information system can be seen in Figure 3.

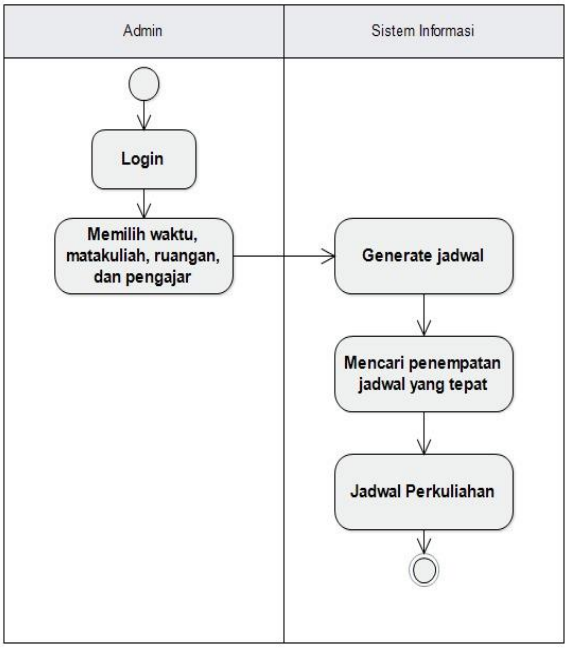


Source: (Zaeniah & Salman, 2020)

Figure 3. Class Diagram

3) Activity Diagram

Activity Diagram is a diagram that describes the activities of a system. The activity diagram of the schedule information system can be seen in Figure 4.

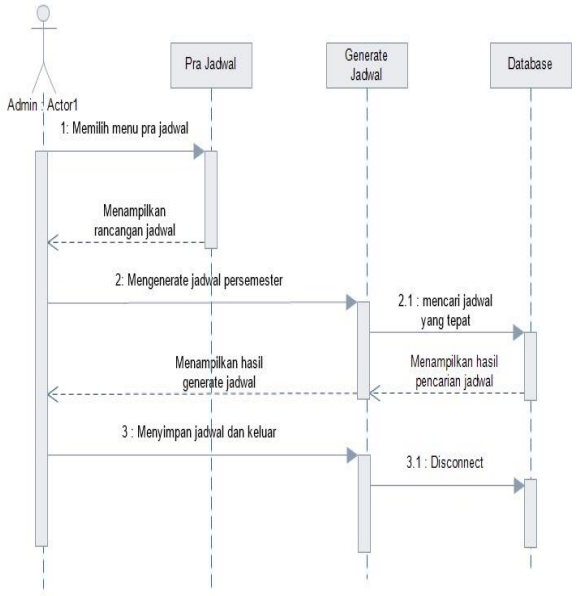


Source: (Zaeniah & Salman, 2020)

Figure 4. Activity Diagram

4) Sequence Diagram

Sequence Diagram is a diagram that is used to describe objects related to the process of running the system and is arranged based on time. Sequence Diagram can be seen in Figure 5.



Source: (Zaeniah & Salman, 2020)

Figure 5. Sequence Diagram

4. Design Validation

Design validation is carried out by information system design experts by providing an assessment of the design that has been made from the aspects of End User Interface Design Quality which consists of the use of font, color selection, language, and button placement (Hernawan & Sidiq). , 2018), with the following results

Table 1. System Design Assessment

Criteria	Test result
Use of Fonts	Good
Color	Good
Language	Good
Button placement	Good

Source : (Zaeniah & Salman, 2020)

5. Revised design.

Design revisions are carried out on the use of fonts and revisions so that the production results on using fonts are very good.

6. Development

The next stage of this method is the stage of creating a program starting from input source code to limited testing to check for error programs. The following is the source code for scheduling using the taboo search method

```
<?php
foreach ($dataMKGJ as $rowmk) {
$datajmk2= $db->jumlah("SELECT * FROM
tbl_viewjadwal WHERE
kode_matakuliah='$rowmk[kode_matakuliah]
' AND kode_kelas='$rowmk[id_kelas]' AND
tahun_akademik='$ta' AND
semester='$sms'");
if ($datajmk2 > 0) {
continue; }
$sksmk = $rowmk['sks'];
if ($sksmk > 3) {
$sksmk=3;
}
$dataW =  $db->tampil("SELECT * FROM
tbl_waktu WHERE sks='$sksmk'");
//Proses Mengambil Waktu Untuk Jadwal
Matakuliah
foreach ($dataW as  $roww) {
$dataJS= $db->jumlah("SELECT b.jam_akhir
FROM tbl_viewjadwal a INNER JOIN
tbl_waktu b ON a.id_waktu = b.id_waktu
where b.hari='$roww[hari]' and
b.jam_akhir>'$roww[jam_awal]' and
b.jam_akhir<'$roww[jam_akhir]' and
b.kode_ruangan='$roww[kode_ruangan]'");
$dataNJ= $db->jumlah("SELECT * FROM
tbl_viewjadwal a INNER JOIN tbl_waktu b
ON a.id_waktu = b.id_waktu where
b.hari='$roww[hari]' and
b.jam_awal='$roww[jam_awal]' and
b.kode_ruangan='$roww[kode_ruangan]'");
if($dataNJ>0 || $dataJS>0){
continue;}
$db->tambah("INSERT INTO tbl_viewjadwal
(kode_matakuliah,kode_ruangan,id_waktu,k
ode_kelas,semester,tahun_akademik)
values
('$rowmk[kode_matakuliah]','$roww[kode_r
uangan]','$roww[id_waktu]','$rowmk[id_ke
las]','$sms','$ta')");
break;
}
?>
```

7. Limited trial.

Limited testing is carried out from 4 characteristics, namely Functionality, Reliability, Portability, and Usability by ISO 9126 standards (Suhartono, 2018). with the following results:

Table 2. System Testing Results

Criteria	Test result
Functionality	Good
Reliability	Good
Portability	Good
Usability	Good

Source : (Zaeniah & Salman, 2020)

8. Revision of the first product

Based on the results of limited testing, revisions have been made and assessed by the user of the functionality character with very good results.

9. Field trials

Field testing was carried out from 4 characteristics, namely Functionality, Reliability, Portability, and Usability by ISO 9126 standards (Suhartono, 2018). with the following results:

Table 3. System Testing Results

Criteria	Test result
Functionality	Very Good
Reliability	Good
Portability	Good
Usability	Good

Source : (Zaeniah & Salman, 2020)

10. Second Product Revision

The second product revision on this system was not carried out by the results of the second trial with good results

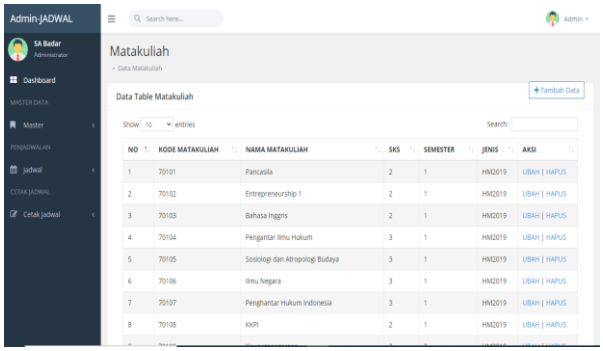
11. Dissemination and Implementation

At this stage, socialization of the system is carried out to users. Display of Information System Lecture Schedule at the Faculty of Information and Communication Technology can be seen in the image below.

Source: (Zaeniah & Salman, 2020)

Figure 6. Main page display

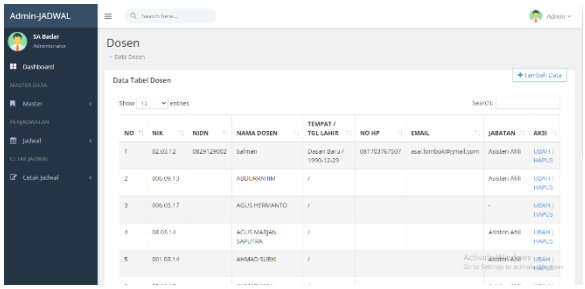
In Figure 6, you can see the initial display of the lecture schedule information system when the user first logs in.



Source: (Zaeniah & Salman, 2020)

Figure 7. Display of Course Data Input Page

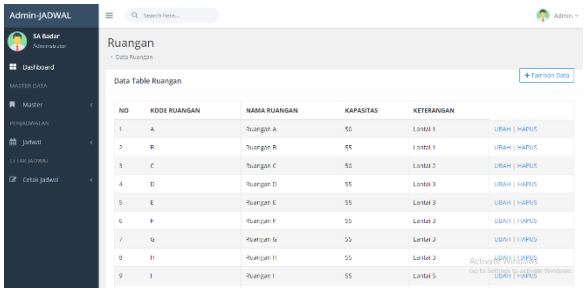
The display in Figure 7 is used to input all courses in the study program at the Faculty of Information and Communication Technology, Mataram University of Technology.



Source: (Zaeniah & Salman, 2020)

Figure 8. Display of Lecturer Data Input Page

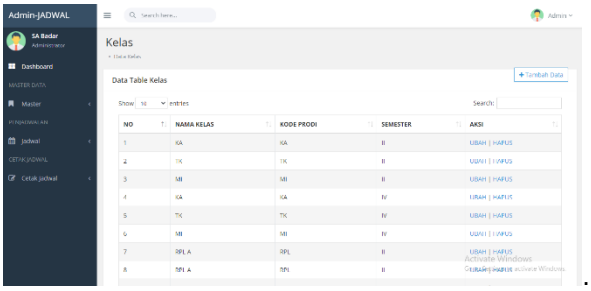
The display in Figure 8 is used to input all lecturers who teach in study programs at the Faculty of Information and Communication Technology, Mataram University of Technology.



Source: (Zaeniah & Salman, 2020)

Figure 9. Display of Room Data Input Page

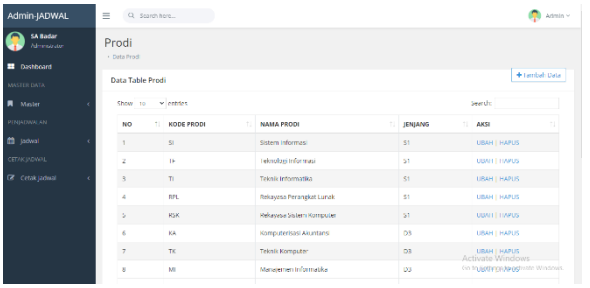
The display in Figure 9 is used to input the entire room used for the teaching and learning process at the Faculty of Information and Communication Technology, Mataram University of Technology.



Source: (Zaeniah & Salman, 2020)

Figure 10. Display Class Data Input Page

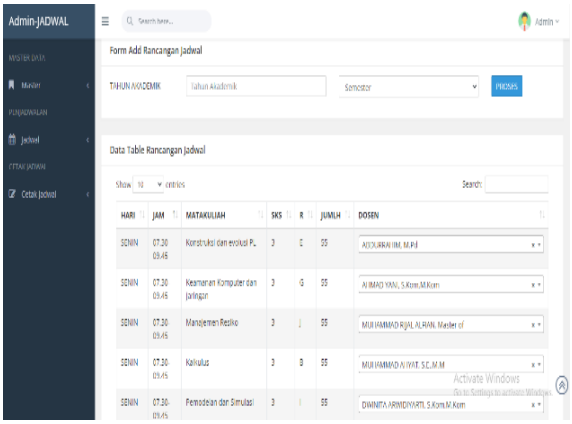
The class data display in Figure 10 is used to input student classes at the Faculty of Information and Communication Technology, Mataram University of Technology.



Source: (Zaeniah & Salman, 2020)

Figure 11. Display of Study Program Data Input Page

The display in Figure 11 is used to input all study programs at the Faculty of Information and Communication Technology, Mataram University of Technology.



Source: (Zaeniah & Salman, 2020)

Figure 12. Display Transaction for Lecture Schedule Making

In Figure 12 above is a display of the schedule setting process by the system according to user needs. After all the data is inputted, the scheduling process can be done properly.

CONCLUSION

This study produces a lecture schedule information system that is completed using the taboo search algorithm. The Taboo-search algorithm is used to help find the best schedule among several available schedule solutions. Class schedule information system made specifically for the Faculty of Information and Communication Technology at the Mataram University of Technology. This system can help the academic department arrange class schedules faster and with the right results.

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