

Design of a Web-Based Lecture Scheduling Information System During Pandemic Covid-19 (Case Study: Faculty of Engineering and Science, Ibn Khaldun University)

Novita BR Ginting¹, Yuggo Afrianto^{2*}, Suratun³

^{1,2}Informatic Engineering Study Program, Faculty of Engineering & Science, Ibn Khaldun University, 16162 Bogor, Indonesia

³Electrical Engineering Study Program, Faculty of Engineering & Science, Ibn Khaldun University, 16162 Bogor, Indonesia

Article Info

Article history:

Received April 24, 2021
Revised July 01, 2021
Accepted August 25, 2021
Published December 26, 2021

Keywords:

BlackBox
Greedy Best First Search
Lectures
RAD
Scheduling

ABSTRACT

During the Covid-19 pandemic, the lecture process was carried out online, so it impacted other academic activities such as the preparation of lecture schedules. The results of observations at the Faculty of Engineering and Science found that the practice of lecture schedules was carried out manually, such as the schedule coordination process was carried out face-to-face between study programs, faculties, and lecturers to overcome conflicts in the use of rooms and teaching time. Changes in the teaching schedule need to be re-checked on the use of the room and the lecturer's teaching time because it has not been documented with the information system. Hence, this study aims to build an information system for preparing lecture schedules using the Greedy Best First Search Method based on the willingness of lecturers to teach. The system was developed using the RAD (Rapid Application Development) and testing using BlackBox testing. The results of this study succeeded in building a lecture scheduling information system that was able to generate lecture schedules automatically and quickly without having to coordinate face-to-face to support online lectures during the Covid-19 pandemic.

Corresponding Author:

Yuggo Afrianto
Department of Informatics,
Ibn Khaldun University Bogor,
Jl. Sholeh Iskandar, RT.01/RW.10, Kedungbadak, Kec. Tanah Sereal, Kota Bogor, Jawa Barat 16162,
Indonesia
Email: yuggo@uika-bogor.ac.id

1. INTRODUCTION

Covid-19 impacts every activity to carry out social restrictions, one of which is in the implementation of education [1]. These restrictions have positive and negative effects on the achievement of learning objectives. The restrictions are very influential in the adaptation period due to changes in learning mechanisms and systems during the Covid-19 pandemic [2]. Information technology is beneficial as an alternative to implementing education and learning to be still carried out online [3]. Scheduling is a process for compiling a schedule or process sequence used to solve a problem [4]. One of the scheduling problems is usually related to the preparation of lecture scheduling [5]. Effective course scheduling impacts the implementation of lectures for students, lecturers, and managers [6].

A lecture schedule is a problem for every university if it is still conventional in its management [7]. The results of observations at the Faculty of Engineering and Science, Ibn Khaldun University, found that scheduling was done manually, using an input form document that had to be printed first. In addition, communication to adjust the availability of time and lecturer teaching so that it can be scheduled still requires time and a lengthy decision because the management of the Study Program still has to conduct several Coordination meetings between Lecturers, the infrastructure, and between Study Programs to adjust time and lecture place. The form of documentation of the results of the implementation of the SOP for Lecture Scheduling is still not well recorded; there is still a missing or missed Lecturer willingness to teach form that is not filled in. Therefore, Prodi needs a mechanism that can facilitate the lecture scheduling process.

Related research on the lecture scheduling information system that has been carried out based on systematic review literature shows two relevant journal articles [7]. Triawan and Faruq (2019) succeeded in creating a system to provide laboratory assistant scheduling recommendations, using the Simulated Annealing algorithm using input from the time habits of each lab assistant [6]. Saputra and Saragih (2018) succeeded in creating a course scheduling system by applying genetic algorithms and using data samples in the Department of Informatics, Faculty of Engineering, Palangka Raya University [5].

Based on the results of research that has been done and some of the problems mentioned above. Scheduling arrangement is made manually, where study programs do a lot of face-to-face coordination. This will also have an impact on the risk of transmission of the Covid-19 outbreak during the pandemic. Hence, scheduling lectures can be a solution in making a computerized lecture schedule based on a web with various similar studies found. The next challenge is to apply one of the methods in the informed searching algorithm using the greedy best-first search method for lecture scheduling problems into an information system with the RAD system development method. One branch of the informed searching algorithm is the greedy best-first search algorithm. This algorithm can be used to generate a node from a previous node [8]. Greedy is used to find the lowest value in a combination of course scheduling [9].

This study aims to obtain a lecture scheduling information system using an informed searching algorithm with the Greedy Best First Search method to generate a class schedule and use the RAD (Rapid Application Development) application development stage to build a web-based information system. This system contributes to the study program management unit at the Faculty of Engineering and Science in scheduling lectures to be faster and optimal. An automated, quick, and appropriate scheduling arrangement model is obtained to be applied during the Covid-19 pandemic.

2. METHOD

This study uses several stages of RAD. RAD is one of the methods in the development of information systems. In the RAD method, the user is directly involved in the step of determining user requirements. At the application development stage, it will be communicated directly with the user to get repeated feedback from the user [10]. The RAD stages are shown in Figure 1:

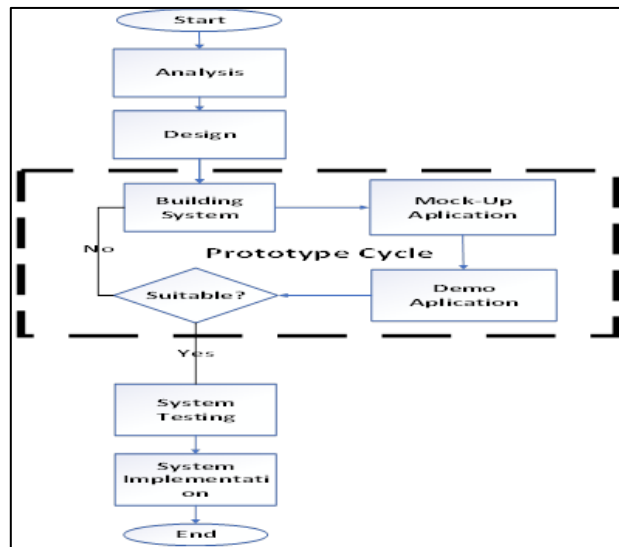


Figure 1. RAD Research Stages

2.1. Analysis Stage

At this stage, business process analysis is carried out on preparing the lecture schedule currently running in each semester by the study program.

2.2. Design Stage

An information system architecture design is carried out at the system design stage using an object-oriented design approach. The architectural design tools used are UML (Unified Modeling Language) diagrams.

2.3 Prototype Cycle Stage

This stage is the implementation of the system design stage, coded into a programming language. Using the PHP programming language, Database Server uses Mysql, Webserver using Apache, and Browser. The result of this stage is a web-based application in the form of an application mock-up. The results of this application mock-up are demonstrated to users to produce an application that suits user needs.

2.4. System Testing Stage

The testing phase is carried out by the BlackBox method to ensure that every process in the lecture scheduling information system can function correctly.

2.5. System Implementation Stage

The installation stage of an information system in the organization that users in preparing lecture schedules can use. At this stage, training is also carried out for all users who will use the system.

3. RESULTS AND DISCUSSION

3.1. Business Process Analysis

The results of the business process analysis of the preparation of lecture schedules in each study program at FTS-UIKA Bogor are as follows:

- a. Lecturers fill out the willingness to teach form that the Study Program has prepared.
- b. Prodi prepares a lecture schedule according to the willingness fields of the lecturers.
- c. Prodi holds a coordination meeting with the lecturers to review the draft lecture schedule that has been compiled.
- d. Prodi conducts a coordination meeting with the deputy dean and head of the administration section to adjust the use of space that each study program can use. If there is no room available, the Study Program will confirm the lecturer for changing the schedule with room availability.
- e. Finally, the study program will issue a definite lecture schedule if everything fits.

The current system flow diagram refers to the Lecture Schedule Arrangement Procedure No. FTS-PRD-P-03.

3.1.1 The weakness of the running system

Based on the analysis of the running system, there are weaknesses, as follows:

- a. The administrative process for preparing lecture schedules is still manual, using the willingness to teach form that each lecturer fills in.
- b. Determining the lecture schedule still needs to be adjusted to the lecturers' time availability and room availability.
- c. The time needed is still a long time to determine the lecture schedule each semester. The preparation of plans, coordination meetings between study programs and faculties has taken a lot of time. This is so that the use of the lecture room is not confusing between courses.
- d. Information on class schedules must still be disseminated to lecturers, students, and education staff using various media.
- e. Class schedule documents are archived manually by study programs and faculties. Currently, the lecture schedule archives are still stored in the filing cabinet.
- f. There are still frequent clashes during lectures or clashes between lecturers in rooms.

3.1.2. Proposed Solution to Problem

Referring to the weaknesses of the running system, this study has built a Lecture Scheduling Information System using the greedy best first web-based search method. This information system serves as a medium for arranging lecture schedules automatically based on the lecturer's teaching willingness data.

3.1.3 Analysis of the proposed system

The lecture scheduling information system uses the greedy best first method based on this website. It can carry out filling in the willingness to teach, and the availability of the room does not need to be manually returned. The system automatically carries out the method of determining the lecture schedule. The students and lecturers can access class schedule information via computer browsers and cellphones without time restrictions.

The business process flow diagram of the proposed system showed in Figure 2 below:

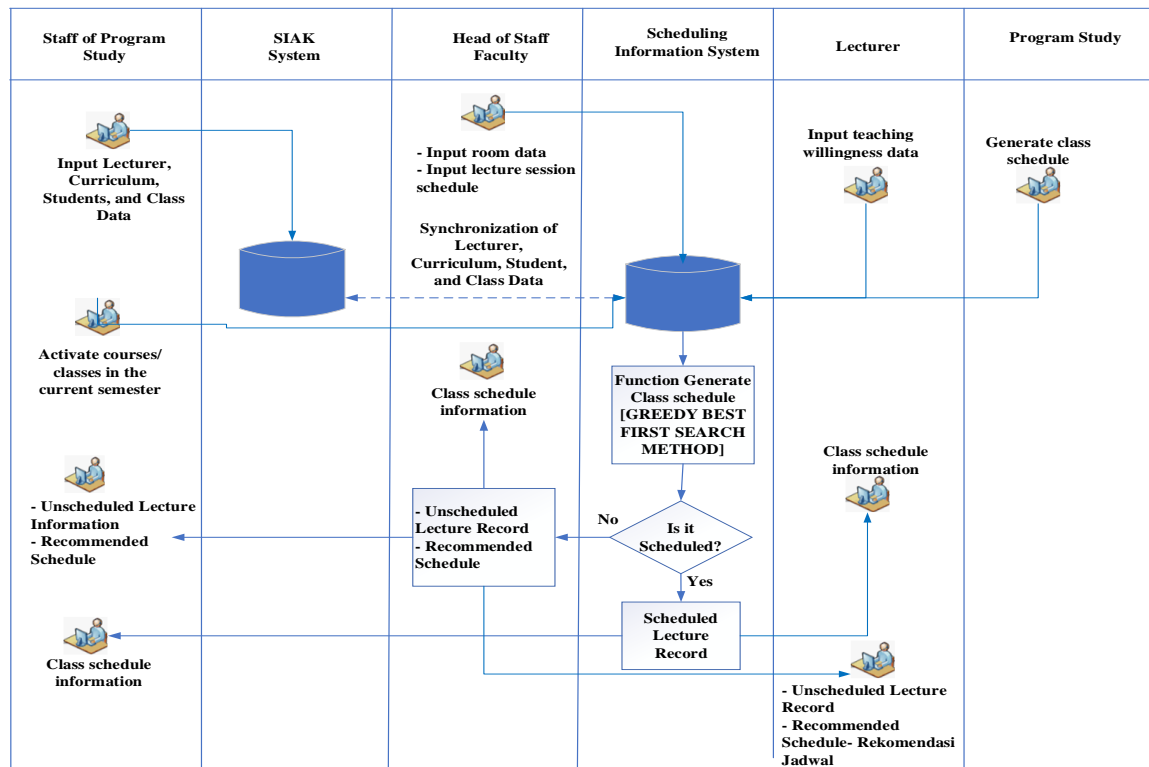


Figure 2. Proposed System

3.1.4 Context Diagram

Context diagram is used to describe the system, in this scheduling system is integrated with the existing system, namely SIAK (Academic and Financial Information System). Context diagram showed in Figure 3.

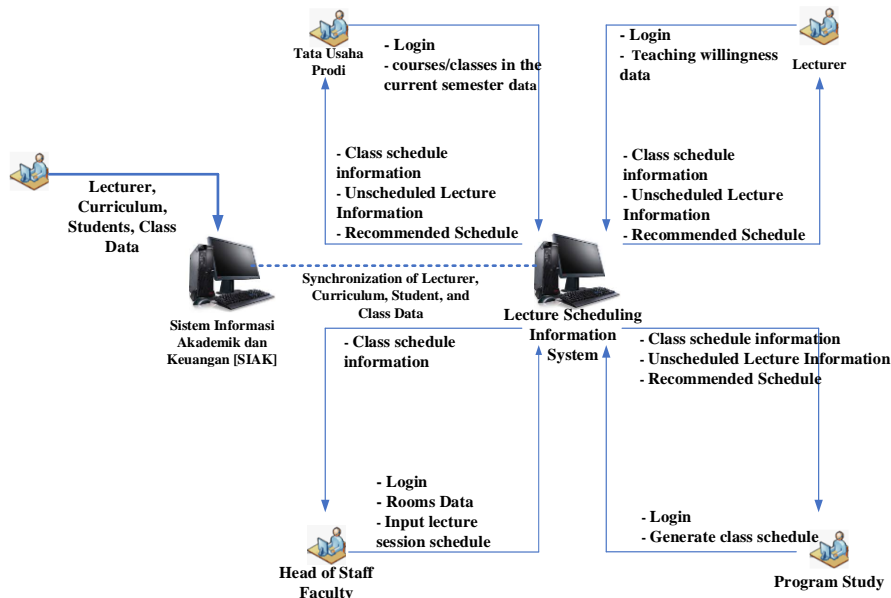


Figure 3. Context Diagram

3.2 System Design

The system design uses the UML system development model with the behaviour diagram type, consisting of Use case diagrams, Activity diagrams, State machine diagrams, Sequence diagrams.

3.2.1. Usecase Diagram

Usecase diagram to explain the interaction of actors with the lecture scheduling information system, use case diagrams are used. The Usecase showed in Figure 4.

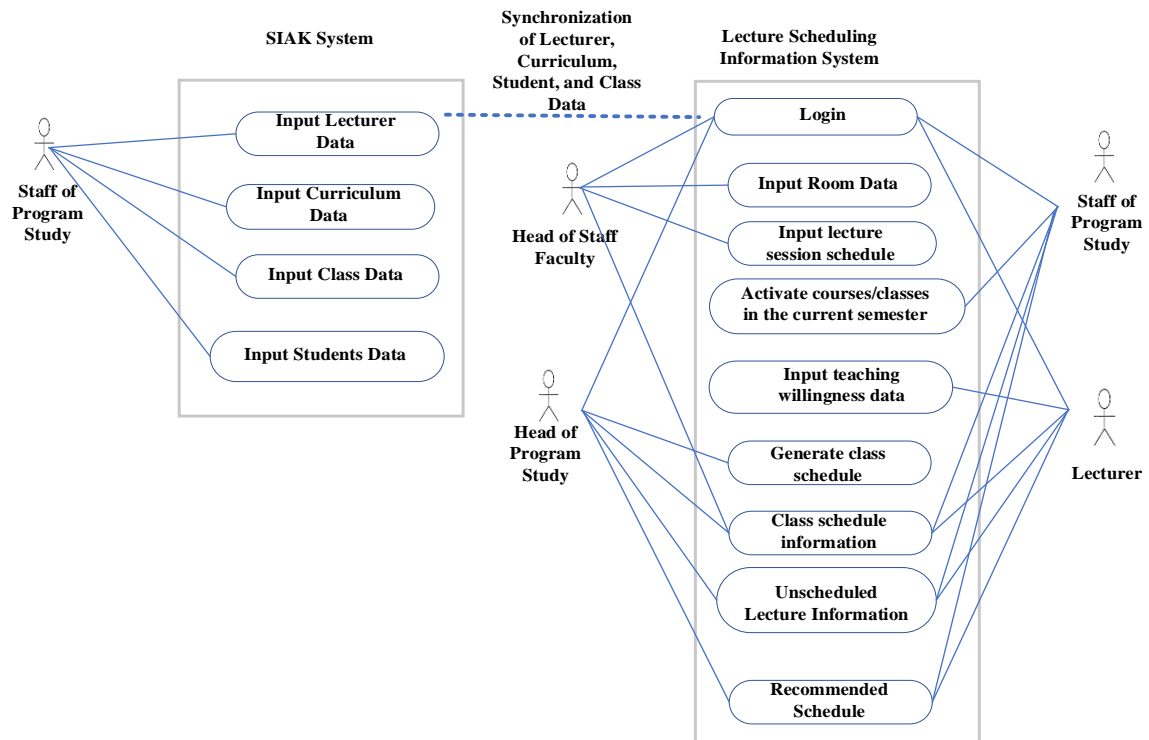


Figure 4. Usecase Diagram

The usecase diagram above shows four actors involved, namely Administration Study Program, Head of Faculty Administration, Head of Study Program, and Lecturers. It can be seen that the scheduling information system is integrated with SIAK for Data_Dosen, Data_Curriculum, Data_Kelas, and Data_Mahasiswa.

3.2.2. Activity Diagram

Activity diagrams are used to describe the activity of the lecture scheduling information system. There are five activity diagrams. There are five activity diagrams, namely: activity input_data_ruangan, activity input_data_sesi_kuliah, activity matakuliah_kelas_semester, activity kesediaan_mengajar, activity generate_schedule.

3.2.3. Sequence Diagram

Sequence Diagram to describe the communication between objects in the lecture scheduling system, a Sequence Diagram is used. There are five sequence diagrams: the input_data_ruang sequence, the input_data_sesi sequence, the matakuliah_kelas_semester sequence, the kesediaan_mengajar sequence, and the generate_schedule sequence.

3.2.4. State Machine Diagram

State machine diagrams describe the changes and transitions of objects in the scheduling information system, model methods or behaviours and show the sequence of events that each object passes through in the scheduling information system.

The process begins with retrieving data from the room object, course, class, and session_cult in the state machine diagram. Furthermore, it is used by the kesediaan_mengajar object. The object of kesediaan_mengajar generates a Rombel (Study Group) output, used by the schedule generate object to generate scheduled and unscheduled lecture schedule information.

This page results from the lecture schedule generation process carried out by the head of the Study Program. Users receive information on a list of courses that have been scheduled for the next semester. The availability form page showed in Figure 7.

Tahun Akademik	Semester	Prodi	Mata Kuliah	Dosen	Kelas	Hari	Jam Mulai	Jam Selesai	Ruang	Alokasi
2019/2020	GASAL	Teknik Sipil	Bahasa Indonesia	Andeaten, S.Pd., M.Pd.	REGULER_A	Jumat	08:00	09:40	R1	
2019/2020	GASAL	Teknik Sipil	Bahasa Indonesia	Andeaten, S.Pd., M.Pd.	REGULER_A	Jumat	08:00	09:40	R1	
2019/2020	GASAL	Teknik Sipil	Bahasa Indonesia	Andeaten, S.Pd., M.Pd.	REGULER_B	Jumat	08:00	09:40	R1	
2019/2020	GASAL	Teknik Mesin	Bahasa Indonesia	Andeaten, S.Pd., M.Pd.	REGULER_A	Jumat	08:00	09:40	Mesin-R1	
2019/2020	GASAL	Teknik Sipil	Historika II (4P)	Feri Karti, S.T., M.Eng	REGULER_B	Jumat	08:00	10:00	309	
2019/2020	GASAL	Teknik Mesin	Bahasa Indonesia	Andeaten, S.Pd., M.Pd.	REGULER_A	Jumat	08:00	09:40	Mesin-R1	
2019/2020	GASAL	Teknik Elektro	Studi Idem III	H. Pamo Siwanto, Drs,MM	REGULER_A	Jumat	08:00	09:40	309	
2019/2020	GASAL	Teknik Elektro	Bahasa Indonesia	Andeaten, S.Pd., M.Pd.	REGULER_A	Jumat	08:00	09:40	4-HH(1)	
2019/2020	GASAL	Teknik Informatika	Sistem Informasi MultiMedia	Fery Fatmaly, M.Kom	REGULER_C	Jumat	08:00	10:00	Lab-SI	
2019/2020	GASAL	Teknik Informatika	Studi Idem III	TMTI	REGULER_A	Jumat	08:00	09:40	205	

Figure 7. Scheduling Information List

3.4 System Testing

Testing the information system on the functional of the application is by the design stage that has been made using the BlackBox technique. The results are shown in Table 1.

Tabel 1. Results of BlackBox Testing

Users	Page	Testing	Results
Lecturer, Staff of Program Study, Head of Program Study, Head of Staff Faculty Head of Staff Faculty	Login	Users can log into the system with an account that has been created.	Suitable : Each users can login according to the privileges that have been set
	Room	View, Add and Modify Room Data.	Suitable : The head of the Faculty staff managed to view, change, and modify the room data
Head of Staff Faculty	Lecture Time Session	View, Add and Modify Lecture session data.	Suitable : The head of the Faculty staff managed to view, change, and modify the lecture session data
Lecturer, Staff of Program Study, Head of Program Study, Head of Staff Faculty Head of Program Study	Lecture Schedule Information	Users can view all course schedules.	Suitable : All users can view course schedules
	Generate Schedule Menu	User can click the button generate schedule.	Suitable : System can generate schedule
Head of Program Study, Lecturer, Staff of Program Study	Unscheduled lecture information	User can view all unscheduled courses.	Suitable : Head of Program Study, Lecturer, Staff of Program Study can view all unscheduled courses
Head of Program Study, Lecturer, Staff of Program Study Lecturer	Schedule Recommendations	Users can see the class schedule recommended by the system.	Not Suitable : System can not generate the lecture schedule recommended
	Willingness to Teach	View, Add and Change Teaching Willingness Data.	Suitable : Lecturer can managed to view, change, and modify the teaching willingness data
Staff of Program Study	Courses	View, Add and Change Data for courses that will be held in the current semester.	Suitable : Staff of Program Study can managed to view, change, and modify the course data

The BlackBox test's overall results found that all pages and functions were as expected, except on the schedule recommendation page, because in the study, it was only until the system was able to generate lecture schedules using the greedy best-first search method automatically. As for the schedule recommendation function, an automatically generated function will be made for further research.

3.5 System Implementation

3.5.1 Implementation of the greedy best first search method

The results of applying the greedy best first search method are used in the generate schedule object, described in the activity diagram, the sequence, and the state machine diagram on the generate_schedule object. The generate_schedule_course algorithm is presented in the following pseudocode form:

```
// greedy program generate_schedule_course best first search method

deskripsi:
set matakuliah, kelas
set ruang, sesi_kuliah
set nc_rombel

for each kesediaan_mengajar:
    insert matakuliah
    insert kelas
    insert ruang
    insert sesi_kuliah
    insert rombel from (matakuliah, kelas, ruang, sesi_kuliah)
from kesediaan_mengajar create queue list_rombel:
    function total_constraint_rombel:
        for rombel in list_rombel:
            total_constraint_rombel = 1
            if rombel(matakuliah, kelas) > 1:
                return total_constraint_rombel =
total_constraint_rombel + 1

        function total_constraint_sesi_kuliah:
            for rombel in list_rombel:
                total_constraint_sesi_kuliah = 1
                if rombel(sesi_kuliah) > 1:
                    return total_constraint_sesi_kuliah =
total_constraint_sesi_kuliah + 1

        function total_constraint_sesi_ruang:
            for rombel in list_rombel:
                total_constraint_sesi_ruang = 1
                if rombel(sesi_kuliah) > 1:
                    return total_constraint_ruang = total_constraint_ruang + 1

    for rombel in list_rombel:
        if rombel(matakuliah, kelas) > 1:
            N1 = 0,2 / function total_constraint_rombel
            else
            N1 = 0;
        if rombel(sesi_kuliah) > 1:
            N2 = 0,4 / function total_constraint_sesi_kuliah)
            else
            N2 = 0;
        if rombel(ruang) > 1:
            N3 = 0,4 / function total_constraint_ruang
            else
            N3 = 0;
        return NC_rombel = N1 + N2 + N3
sort rombel berdasarkan nilai NC_rombel tertinggi to list_rombel
for slot_rombel in list_rombel:
    generate slot_waktu
    function p_rombel:
        if slot_rombel(sesi_kuliah) == current_sesi_slot_waktu:
            p1 = 0
            else
            p1 = 0.20
        if slot_rombel(ruang) == current_ruang_slot_waktu:
            p2 = 0
            else
            p2 = 0.20
        if current_ruang_slot_waktu = terisi:
            p3 = 0.60
            else
            p3 = 0
        return p_rombel = p1 + p2 + p3
    if p_rombel > 0:
        set p_rombel_tidak_terjadwal
        open new slot_waktu
        function p_rombel
    else
        set p_rombel_terjadwal
```


3.5.2 Implementation of Information Systems

From the results of the system development, it is obtained a lecture scheduling information system that can generate schedules automatically. The results of the implementation of the lecture schedule showed in Figure 8.

Report

Tahun Akademik	2019/2020	Semester	GASAL
Program Studi	Teknik Mesin	Kelas	KARYAWAN_LA
Cari	<input type="text"/> <input type="button" value="Cari"/> <input type="button" value="Kembali"/> <input type="button" value="Bantuan"/>		

JADWAL PERKULIAHAN SEMESTER GASAL TAHUN AKADEMIK 2019/2020
PROGRAM STUDI TEKNIK MESIN CLASS KARYAWAN_LA

SENIN					SELASA				
code	Matakuliah	Dosen	Pukul	Ruang	code	Matakuliah	Dosen	Pukul	Ruang
TME482	Metodologi Penelitian	Aisyah Iadha Nuraini, S.T., M.T., MBA.	18:30 - 20:10	304	TME221	Matematika Teknik	Dr. Dawi Sanderi, S.T., M.Si.	18:30 - 20:10	208
FTK431	Bhs. Indo. Unt. Teknik Pen. & Pres.	Andester, S.Pd., M.Pd.	18:30 - 20:40	Mesjid-R1	TMS425	Teknologi Pengecoran Logam	Sumadi, S.T., M.T., I.PM.	18:30 - 21:00	Lab. Man
PBI132	Bahasa Inggris	Irvan Wiradinata, S.I.Kom., M.Sc.	18:30 - 20:10	207	FTK215	Matematika Teknik II	Dr. Dawi Sanderi, S.T., M.Si.	18:30 - 20:10	208
TME342	CAD/CAM + Praktikum	Getot Eka Pramono, S.T., M.T.	18:30 - 20:10	209	TMS336	Pengukuran Teknik	Setya Permata Sutisna, S.T.P., M.Si.	18:30 - 20:10	304
TMS332	Praktikum CAD/CAM	Getot Eka Pramono, S.T., M.T.	18:30 - 20:10	209	TME441	Teknologi Pengecoran Logam	Sumadi, S.T., M.T., I.PM.	18:30 - 21:00	Lab. Man
TME471	Kerja Praktek	Setya Permata Sutisna, S.T.P., M.Si.	18:30 - 20:10	207	TME451	Sistem Refrigerasi	Dr. Rudi Irawan, Dipl. Geotherm. En.Tech., M.Sc.	18:30 - 21:00	Lab. Energi
TME342	CAD/CAM + Praktikum	Getot Eka Pramono, S.T., M.T.	18:30 - 20:10	209					
TME455	Motor Bakar dan Sistem Peralatan 2	Dr. H. Yogi Sirodz Ghoz, Ir., M.T.	18:30 - 21:00	LAB. NH					
TME482	Metodologi Penelitian	Aisyah Iadha Nuraini, S.T., M.T., MBA.	18:30 - 20:10	304					

Figure 8. Lecture Scheduling Information System

4. CONCLUSION

This study applies the Informed Searching algorithm using the Greedy Best First Search method in the lecture scheduling information system. This lecture scheduling information system successfully processes online administration, the communication process between study programs, infrastructure, and lecturers no longer coordinate face-to-face, administrative and scheduling documentation data are recorded in the system so that it is easy to manage, and there are no clashes in class schedules lectures generated automatically by the system so that lecturers' teaching schedule information is informed directly and to support online lectures during the Covid-19 pandemic.

In this study, there is a process that has not been implemented to recommend unscheduled class schedules because the Greedy Best First Search method is used to solve schedule problems. Then further research can be developed to apply a certain method in completing the unscheduled course recommendation process.

ACKNOWLEDGEMENTS

Thank you to RISTEK-BRIN and Ibn Khaldun University, who have funded and supported this research grant through the Penelitian Dosen Pemula scheme for the year 2020, through Decree Number: 8 / E1 / KTP / 2020 with Contract Number: 035 / SP2H / LTMONO / LL4 / 2020. Implemented through a research contract between the Chancellor of Ibn Khaldun University and the Research Head with No. 228 / K.5 / LPPM-UIKA / 2020

5. REFERENCES

- [1] N. Rohim Yunus and A. Rezki, "Kebijakan Pemberlakuan Lockdown Sebagai Antisipasi Penyebaran Corona Virus Covid-19," *SALAM J. Sos. dan Budaya Syar-i*, vol. 7, no. 3, 2020, doi: 10.15408/sjsbs.v7i3.15048.
- [2] I. Wahyuni, "Dinamika Pembelajaran 'DARING' Pada Masa Pandemi COVID 2019," *Institut Agama Islam Negeri Kendari*, 2020. http://iainkendari.ac.id/content/detail/dinamika_pembelajaran_daring_pada_masa_pandemi_covid (accessed May 02, 2021).
- [3] U. Hanifah Salsabila, L. Irna Sari, K. Haibati Lathif, A. Puji Lestari, and A. Ayuning, "Peran Teknologi Dalam Pembelajaran Di Masa Pandemi Covid-19," *Al-Mutharahah J. Penelit. dan Kaji. Sos. Keagamaan*, vol. 17, no. 2, pp. 188–198, Nov. 2020, doi: 10.46781/al-mutharahah.v17i2.138.
- [4] B. J. Maspaitella and J. M. Tupan, "Model Integer Programming (Studi Kasus Pada Jurusan Teknik Industri Fakultas Teknik Universitas Pattimura Ambon)," *Arika*, vol. 10, no. 1, 2016.
- [5] A. C. Saputra and A. S. Saragih, "Aplikasi Penjadwalan Mata Kuliah Jurusan Teknik Informatika Fakultas Teknik Universitas Palangka Raya Dengan Algoritma Genetika," *J. Teknol. Inf.*, vol. 12, no. 2, pp. 81–97, 2018, [Online]. Available: <http://e-journal.upr.ac.id/index.php/JTI/article/download/527/461>.
- [6] A. Triawan and M. Al Faruq, "Penerapan algoritma simulated annealing pada notifikasi informasi jadwal menggunakan RESTFUL api untuk rekomendasi jadwal asistensi di laboratorium komputer," *J. Ilm. Teknol. - Inf. Sains*, vol. 9, no. 2, pp. 91–101, 2019, [Online]. Available: <http://teknoinstikombinaniaga.ac.id/index.php/JBS/article/view/69>.

- [7] Y. Afrianto, B. Wulandari, and N. B. Ginting, "Method of Systematic Literature Review for Identification of Lecture Scheduling Information Systems," *J. Tek. Inform. C.I.T Medicom*, vol. 12, no. 2, pp. 41–48, 2020.
- [8] I. Muslimin, "Penerapan Algoritma Greedy Best First Search untuk Menyelesaikan Permainan Chroma Test : Brain Challenge," 2016.
- [9] Yasmin Math Khader, "Penjadwalan Matakuliah Menggunakan Algoritma Greedy (Studi Kasus Penjadwalan Semester Ganjil 2017-2018)," *Jitter*, vol. IV, no. 3, pp. 207–213, 2018.
- [10] D. Ajeng and A. Mulyana, "Sistem Informasi Monitoring Skripsi Berbasis Web (Studi Kasus : Prodi Akuntansi Universitas Mercu Buana)," *J. Sist. Inf. Bisnis*, vol. 01, pp. 56–63, 2020, [Online]. Available: <https://ejournal.undip.ac.id/index.php/jsinbis/article/view/25712%0A>.