IT Journal Research and Development (ITJRD)
Vol.7, No.1, August 2022, E-ISSN : 2528-4053 | P-ISSN : 2528-4061
DOI : 10.25299/itjrd.2022.7976

Implementing the Modified Euclidean Distance Method in the Course Planning of the USN Kolaka Information Systems Curriculum

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Article Info

Article history:

Received Oct 31, 2021
Revised Jan 18, 2022
Accepted Jun 23, 2022

Keyword:

Scheduling
Euclidean Distance
Algorithm

ABSTRACT

Scheduling is needed to anticipate the clash of lecture hours for lecturers in teaching. Some things that need to be considered when arranging a lecture schedule are lecturers, rooms, courses, hours, and days. In this study, the scheduling system uses the Euclidean Distance method by modifying the algorithm. The aim of this study is to prove the Euclidean distance method in the course planning system in universities. In general, to obtain data that will be used in the scheduling system, observations, interviews and bibliographic studies are carried out. From the research results, the lecture scheduling system using the Euclidean Distance method can be used in the scheduling system, especially lecture scheduling. This is proven, that the lecture scheduling system using the Euclidean Distance method does not have a schedule for lecturers who teach more than one course at the same time (collide).

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1. INTRODUCTION

The development of more and more advanced technology offers many conveniences and facilities in the life of the educational world, especially the planning of lessons. The course schedule must absolutely exist in a university, because it has become the basis of the agenda for the courses to run smoothly.

Programming is generally necessary to anticipate conflicts between class hours and teachers' teaching time. The scheduling problem is a problem that is found in all universities. To determine the timetable, it takes a long enough time to find a solution. In addition, programming that is done manually has many shortcomings, one of which is that it focuses more on the interests of the speakers.

In the study program on Information Systems, Universitas Sembilanbelas November Kolaka, the course planning process is carried out manually, that is, it does not use certain planning methods. So in the preparation of the timetable, there is often a conflict between the professors who support the subject and the study room that will be used. Indeed, the number of professors and study rooms in the Sembilanbelas November Kolaka University information systems study program is quite large.

There is therefore a need for automatic programming that can be synchronized between the teachers in charge of the lessons with the study rooms that will be used in class, that is to say the teachers who teach during the available lesson hours.

Some things to consider when compiling a lesson plan are speakers, rooms, classes, times, and days. Determining the wrong scheduling system can cause many problems that hurt teachers and students, namely the appearance of schedules with teachers teaching more than one course at the same time (conflict). The process of creating a long class schedule often results in professors getting late schedules, so it's not uncommon for professors not to come and teach in the first few weeks of class. Therefore, we need an algorithm or a method that can determine the scheduling automatically.

In this study, the scheduling system uses the Euclidean distance method by modifying the algorithm. Euclidean distance is a method used to measure the distance between 2 different points. Where each point is represented in multidimensional [eros]. This method has a simple formula as shown in the following formula.

$$D_{Euc} = \sqrt{\sum_{i=1}^{n} \left(x_i - y_j\right)^2} \quad (1)$$

Where x is the distribution of course tutors, y is the schedule of available rooms and n is the number of data.

The algorithm with the modified Euclidean distance method is as follows.

1. Generate x value and y value at random.
2. Calculate the distance between the teacher responsible for the course and the available time using the Euclidean distance method.
3. Check the ith buffer at the distance that has the closest (smallest) value if it collides. If it collides, repeat step 2, and if there isn't, label it on the j space plane.
4. Repeat step 2 until you finish by not calculating the y value in the labeled space schedule.

While the flowchart of the planning system using the Euclidean distance method, as shown in Figure 1 below.

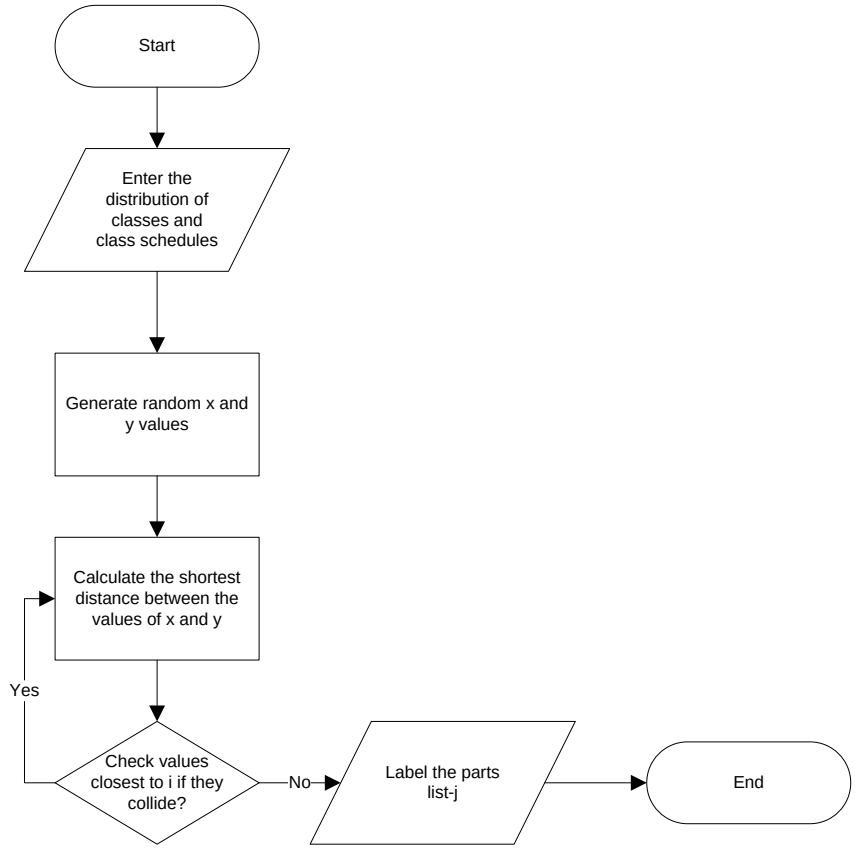

Figure 1. Flowchart of the planning system

2. RESEARCH METHOD

In a previous study [1], a course planning system was developed using the genetic algorithm method with a tournament selection technique. From the test results, the system can provide convenience and speed to the user in the process of creating or compiling a lecture program, which takes only about 14.7 minutes compared to the manual process which takes about 2 (two) days. Then [2], the course scheduling system by applying the method of the Steepest-Ascent Hill Climbing Algorithm. Based on the results of the research, analysis and design of the resulting application using the steepest escalation algorithm, it can be applied to simplify the conference planning process. In addition [3], the design of an information system for the scheduling of university resources uses the Particle Swarm Optimization (PSO) method. The results of the resource and constraint analysis using the PSO algorithm paying attention to hard constraints and soft constraints were not able to produce optimal solutions because there are always conflicts of speaker-time interval. In addition to the last [4], the course planning system of the Electrical Engineering Training Department of the Engineering Faculty of Makassar State University uses PHP. Next, research [5], the ordering system using the genetic algorithm at the Faculty of Medicine of the University of Muhammadiyah Jakarta, and research [6] using the genetic algorithm for the ordering system in the STMIK Semarang province. Research [7] uses the Weighted Round Robin method for server load planning, and [8] for planning uses the Genetic Algorithm method which is implemented on a web basis.

Application of Euclidean distance algorithm [9] for selecting internet packages by region, [10] for ranking bus transport, [11] for ranking Indonesian-speaking participants' degrees, [12] for obtaining information regarding the image of TNI Berets, [13] for Air Pollution Standards Index Data, [14] for Classification of Instagram Bullying Comments and [15] for Prediction of Sengon Sawmill Results

While research uses the Euclidean distance method, among others, [16] to map a web-based pension. In addition, [17] which uses the Euclidean distance method for facial recognition, and [18] which applies the Euclidean distance method for clothing size recommendations in the application of a virtual locker room. And [19] combines the KNN and Euclidean Distance methods for the prediction of national examination graduation, and [20] using the Euclidean distance method to predict national exam success.

While the steps of this research, namely: the preparation and analysis of the needs of the software to work on, the next step is the realization of the design of the application. The next step is the implementation of the program code using various tools and programming languages as needed. In this research, the programming language used is Visual FoxPro. In the last step, the modules that were created in the previous step are combined and tested.

3. RESULTS AND ANALYSIS

3.1. Course Planning Data

The data necessary for this planning system research are the distribution of lessons and classroom schedules. In Table 1, the distribution of courses in the USN Kolaka Information Systems curriculum is presented. Where data on subject distribution is based on the results of the meeting held at the USN Kolaka Information Systems Study Program.

Table 1. Distribution of courses

No	Code	Lecturer Name	Course
1	INA-A	Dosen	Bahasa Indonesia
2	INA-B	Dosen	Bahasa Indonesia
3	INA-C	Dosen	Bahasa Indonesia
4	ING-A	Dosen	Bahasa Inggris 1
5	ING-B	Dosen	Bahasa Inggris 1
6	ING-C	Dosen	Bahasa Inggris 1
7	AGM-A	Dosen	Pendidikan Agama 1
8	AGM-B	Dosen	Pendidikan Agama 1
9	AGM-C	Dosen	Pendidikan Agama 1
10	ALG-A	Dosen	Algoritma & Bahasa Pemrograman
11	ALG-B	Dosen	Algoritma & Bahasa Pemrograman
12	ALG-C	Dosen	Algoritma & Bahasa Pemrograman
13	APK-A	Dosen	Aplikasi Perkantoran
14	APK-B	Dosen	Aplikasi Perkantoran
15	APK-C	Dosen	Aplikasi Perkantoran
16	LOG-A	Dosen	Logika Informatika
17	LOG-B	Dosen	Logika Informatika
18	LOG-C	Dosen	Logika Informatika
19	PKN-A	Dosen	Pendidikan Pancasila & Kewarganegaraan
20	PKN-B	Dosen	Pendidikan Pancasila & Kewarganegaraan
…	…	…	…
64	DGS-A	Dosen	Desain Grafis
65	DGS-B	Dosen	Desain Grafis
66	DGS-C	Dosen	Desain Grafis
67	DGS-D	Dosen	Desain Grafis
68	DGS-E	Dosen	Desain Grafis
69	SPR-A	Dosen	Sistem Pakar
70	SPR-B	Dosen	Sistem Pakar
71	SPR-C	Dosen	Sistem Pakar
72	SPR-D	Dosen	Sistem Pakar

73	SPR-E	Dosen	Sistem Pakar
…	…	…	…
99	SPM-A	Dosen	Sistem Pendukung Manajemen
100	SPM-B	Dosen	Sistem Pendukung Manajemen
101	SPM-C	Dosen	Sistem Pendukung Manajemen
102	SPM-D	Dosen	Sistem Pendukung Manajemen
103	SPM-E	Dosen	Sistem Pendukung Manajemen
104	STS-A	Dosen	Sistem Terdistribusi
105	STS-B	Dosen	Sistem Terdistribusi
106	STS-C	Dosen	Sistem Terdistribusi
107	STS-D	Dosen	Sistem Terdistribusi
108	STS-E	Dosen	Sistem Terdistribusi
109	TKS-A	Dosen	Tata Kelola Sistem Informasi
110	TKS-B	Dosen	Tata Kelola Sistem Informasi
111	TKS-C	Dosen	Tata Kelola Sistem Informasi
112	TKS-D	Dosen	Tata Kelola Sistem Informasi
113	TKS-E	Dosen	Tata Kelola Sistem Informasi

In Table 2, the schedule of conference rooms available in the USN Kolaka Information Systems Curriculum is shown.

Table 2. Parts schedule

No	Code	Day	Clock	Room
1	JDL374	Senin	07.30-09.45	1
2	JDL976	Senin	10.00-12.15	1
3	JDL939	Senin	13.00-15.15	1
4	JDL442	Senin	07.30-09.45	2
5	JDL037	Senin	10.00-12.15	2
6	JDL948	Senin	13.00-15.15	2
7	JDL916	Senin	07.30-09.45	3
8	JDL343	Senin	10.00-12.15	3
9	JDL994	Senin	13.00-15.15	3
10	JDL306	Senin	07.30-09.45	4
11	JDL222	Senin	10.00-12.15	4
12	JDL439	Senin	13.00-15.15	4
13	JDL296	Senin	07.30-09.45	5
14	JDL403	Senin	10.00-12.15	5
15	JDL179	Senin	13.00-15.15	5
16	JDL809	Senin	07.30-09.45	6
17	JDL797	Senin	10.00-12.15	6
18	JDL973	Senin	13.00-15.15	6
19	JDL663	Senin	07.30-09.45	7
20	JDL646	Senin	10.00-12.15	7
21	JDL564	Senin	13.00-15.15	7
22	JDL206	Senin	07.30-09.45	8
23	JDL026	Senin	10.00-12.15	8
24	JDL811	Senin	13.00-15.15	8
25	JDL426	Senin	07.30-09.45	9
26	JDL117	Senin	10.00-12.15	9
27	JDL747	Senin	13.00-15.15	9
28	JDL505	Senin	07.30-09.45	10
29	JDL999	Senin	10.00-12.15	10

30	JDL698	Senin	13.00-15.15	10
31	JDL447	Senin	07.30-09.45	11
32	JDL776	Senin	10.00-12.15	11
…	…	…	…	…
100	JDL451	Kamis	07.30-09.45	1
101	JDL141	Kamis	10.00-12.15	1
102	JDL032	Kamis	13.00-15.15	1
103	JDL612	Kamis	07.30-09.45	2
104	JDL015	Kamis	10.00-12.15	2
105	JDL017	Kamis	13.00-15.15	2
106	JDL286	Kamis	07.30-09.45	3
107	JDL148	Kamis	10.00-12.15	3
108	JDL428	Kamis	13.00-15.15	3
109	JDL347	Kamis	07.30-09.45	4
110	JDL356	Kamis	10.00-12.15	4
…	…	…	…	…
151	JDL289	Jum'at	07.30-09.45	7
152	JDL502	Jum'at	10.00-12.15	7
153	JDL159	Jum'at	13.00-15.15	7
154	JDL044	Jum'at	07.30-09.45	8
155	JDL486	Jum'at	10.00-12.15	8
156	JDL065	Jum'at	13.00-15.15	8
157	JDL336	Jum'at	07.30-09.45	9
158	JDL574	Jum'at	10.00-12.15	9
159	JDL415	Jum'at	13.00-15.15	9
160	JDL585	Jum'at	07.30-09.45	10
161	JDL545	Jum'at	10.00-12.15	10
162	JDL781	Jum'at	13.00-15.15	10
163	JDL907	Jum'at	07.30-09.45	11
164	JDL733	Jum'at	10.00-12.15	11
165	JDL184	Jum'at	13.00-15.15	11

From the above table, it can be explained that the number of subject distribution data is 113, and the number of room nomenclature data available is 165. After the data is collected, the next step is calculating the planning system using formula (1) with a modified algorithm. The calculation of the scheduling system is based on the following algorithm.

Generate *x* value and *y* value at random

Table 3. Random value of *x*

No	Code	Value *x*
1	INA-A	0,6602
2	INA-B	0,8722
3	INA-C	0,6776
4	ING-A	0,2250
5	ING-B	0,8305
6	ING-C	0,1657
7	AGM-A	0,9885
8	AGM-B	0,4018
9	AGM-C	0,4421
10	ALG-A	0,1164
11	ALG-B	0,8843
12	ALG-C	0,7920
13	APK-A	0,8590

14	APK-B	0,3413
15	APK-C	0,3915
16	LOG-A	0,6668
17	LOG-B	0,0170
18	LOG-C	0,4723
19	PKN-A	0,3043
20	PKN-B	0,3675
…	…	…
111	TKS-C	0,6108
112	TKS-D	0,3906
113	TKS-E	0,0554

Table 4. Random value of *y*

No	Code	Value *y*
1	JDL374	0,8268
2	JDL976	0,3906
3	JDL939	0,0739
4	JDL442	0,7343
5	JDL037	0,8146
6	JDL948	0,6883
7	JDL916	0,6694
8	JDL343	0,8646
9	JDL994	0,3173
10	JDL306	0,4186
11	JDL222	0,8381
12	JDL439	0,5728
13	JDL296	0,3617
14	JDL403	0,6552
15	JDL179	0,5821
…	…	…
161	JDL545	0,9313
162	JDL781	0,3022
163	JDL907	0,4853
164	JDL733	0,7131
165	JDL184	0,0591

Next, calculate the proximity distance between x and y using the Euclidean distance method. Example of calculation of code INA-A with code JD374.

$$D = \sqrt{(0{,}6602 - 0{,}8268)^2} = 0{,}1666$$

etc. The full calculation is shown in Table 5 below.

Table 5. Calculation of the distance x_i to y_j

Code x	Value x	Code y	Value y	D
INA-A	0,6602	JDL374	0,8268	0,1666
INA-A	0,6602	JDL976	0,3906	0,2696
INA-A	0,6602	JDL939	0,0739	0,5863
INA-A	0,6602	JDL442	0,7343	0,0741
INA-A	0,6602	JDL037	0,8146	0,1544
INA-A	0,6602	JDL948	0,6883	0,0281

INA-A	0,6602	JDL916	0,6694	0,0092
…	…	…	…	…
INA-A	0,6602	JDL447	0,4690	0,1912
INA-A	0,6602	JDL776	0,9791	0,3189
INA-A	**0,6602**	**JDL353**	**0,6598**	**0,0004**
INA-A	0,6602	JDL218	0,5794	0,0808
…	…	…	…	…
INA-A	0,6602	JDL574	0,9143	0,2541
INA-A	0,6602	JDL415	0,8871	0,2269
INA-A	0,6602	JDL585	0,4593	0,2009
INA-A	0,6602	JDL545	0,9313	0,2711
INA-A	0,6602	JDL781	0,3022	0,358
INA-A	0,6602	JDL907	0,4853	0,1749
INA-A	0,6602	JDL733	0,7131	0,0529
INA-A	0,6602	JDL184	0,0591	0,6011

Based on the calculation of the proximity value between x and y, the closest distance is 0.0004. For the code INA-A (Indonesian) in the distribution of lessons to obtain a room schedule with the code JDL353. Where, in this case, the code JDL353 is the room schedule on Monday from 1:00 p.m. to 3:15 p.m. in room 11.

The complete results of the scheduling system are shown in Table 6 below.

Table 6. Results of scheduling calculations

Code x	Value x	Code y	Value y	D
INA-A	0,6602	JDL353	0,6598	0,0004
INA-B	0,8722	JDL141	0,8794	0,0072
INA-C	0,6776	JDL389	0,6736	0,0040
ING-A	0,2250	JDL341	0,2236	0,0014
ING-B	0,8305	JDL906	0,8305	0,0000
ING-C	0,1657	JDL988	0,1691	0,0034
AGM-A	0,9885	JDL957	0,9882	0,0003
AGM-B	0,4018	JDL811	0,4031	0,0013
AGM-C	0,4421	JDL383	0,4349	0,0072
ALG-A	0,1164	JDL533	0,1203	0,0039
…	…	…	…	…
SPR-A	0,5191	JDL032	0,5153	0,0038
SPR-B	0,2517	JDL619	0,247	0,0047
SPR-C	0,8502	JDL781	0,3022	0,0070
…	…	…	…	…
SPM-B	0,5734	JDL515	0,574	0,0006
SPM-C	0,8520	JDL747	0,8531	0,0011
SPM-D	0,6120	JDL801	0,6138	0,0018
SPM-E	0,4382	JDL514	0,4349	0,0033
STS-A	0,2403	JDL376	0,2401	0,0002
STS-B	0,7815	JDL111	0,779	0,0025
STS-C	0,6465	JDL673	0,6487	0,0022
STS-D	0,5072	JDL517	0,5127	0,0055
STS-E	0,8118	JDL037	0,8146	0,0028
TKS-A	0,6221	JDL887	0,6291	0,0070
TKS-B	0,2315	JDL879	0,2215	0,0100
TKS-C	0,6108	JDL474	0,6097	0,0011
TKS-D	0,3906	JDL976	0,3906	0,0000
TKS-E	0,0554	JDL502	0,0547	0,0007

3.2. Implementation of the Planning System

The main support of this planning system is the use of the lesson planning application. Through the lesson planning app, each study program manager will get information about the planning results of each teacher in charge of each semester.

The Lesson Planning System dialog page is shown in Figures 2-4 below.

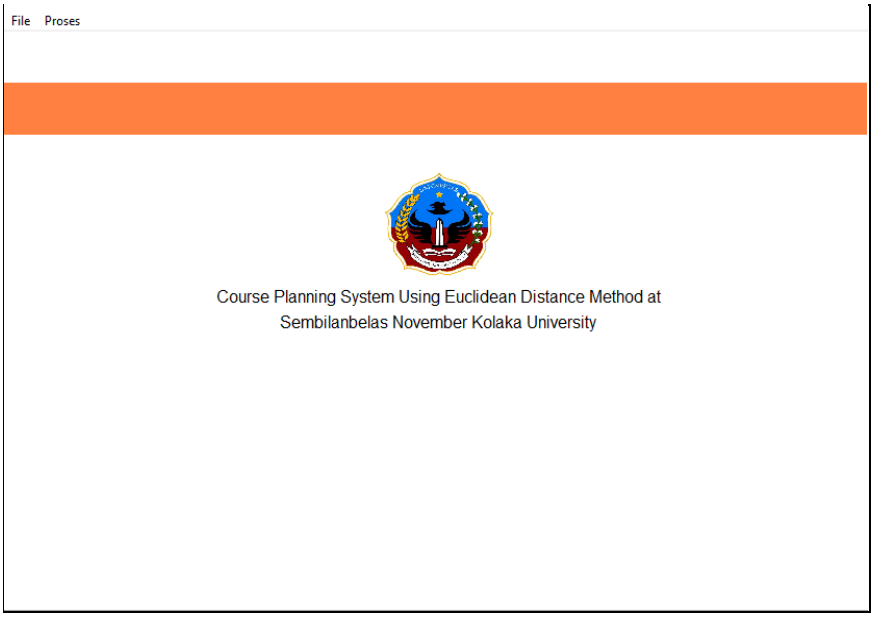

Figure 2. Home dialog page

This main page is the page that appears the first time the scheduling application is run.

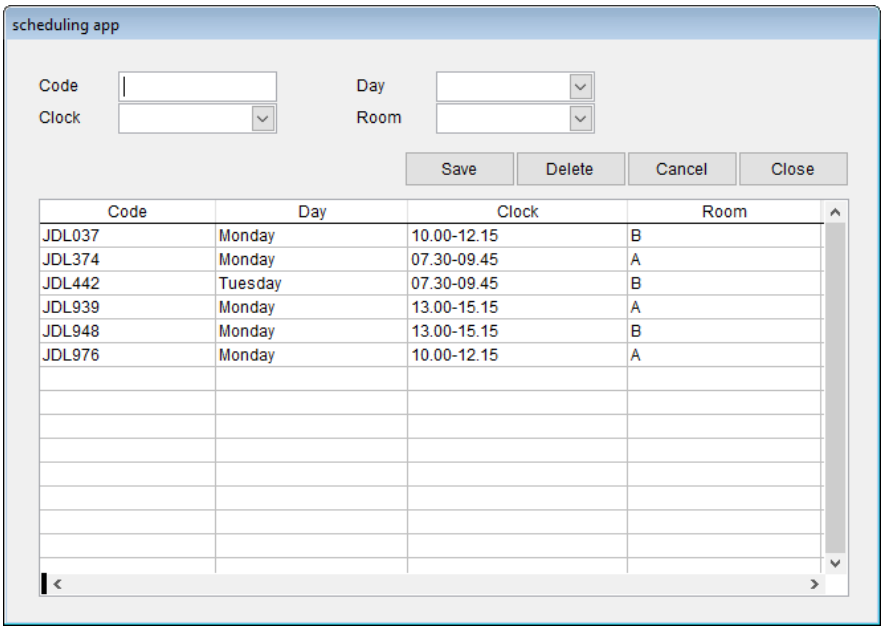

Figure 3. Lesson Schedule Dialog Page

This page is used to enter the room used in the lessons

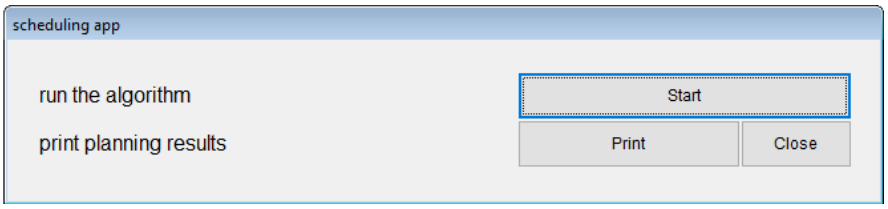

Figure 4. Planning Process Dialog Page

4. CONCLUSION

From the results of research and discussion of course planning system using Euclidean distance method, it can be concluded that Euclidean distance method can be used in planning systems, especially course planning .

In addition, the course planning system using the Euclidean distance method has been shown to be able to solve problems detrimental to teachers and students, such as the emergence of schedules of lecturers who teach more than one course in same time (conflict).

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