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Application Of Particle Swarm Optimization Algorithm In Information Systems Class Scheduling SMK Panca Budi 1 Medan

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ABSTRACT (10 PT, Bolt)

The class scheduling information system with the Particle Swarm Optimization Algorithm method at SMK Panca Budi 1 Medan is the division of student subject time scheduling. Good class scheduling and meeting all the conditions where teachers teach in two majors is one of the things that ensures the smooth implementation of teaching and learning activities. Using another approach, namely the PSO Algorithm Method, is expected to be useful and able to provide understanding and convenience to users to make class scheduling reports into the class scheduling system at SMK Panca Budi 1 Medan, which produces class scheduling reports in an arranged manner and does not cause clashes between teachers who teach in both departments.

Keyword : Class Schedule Information System, Subject, Visual Studio 2010

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1. INTRODUCTION

Scheduling is a process, a way, or a division of time based on a detailed arrangement plan. There are many things that must be scheduled in a school, including the process of scheduling classes, such as days, teaching hours, subjects, classrooms, teachers who teach, and majors. Scheduling classes is important. Good scheduling and meeting all conditions, especially at SMK Panca Budi 1 Medan, and there will be no clashes in subjects where teachers who teach in two departments are one of the things that ensure the smooth implementation of teaching and learning activities.

Scheduling analysis using another approach, namely the Particle Swarm Optimization Algorithm Method, is based on the behavior of a bird or fish. The PSO algorithm performs searches using the population (swarm) of individuals (particles), which will be updated from interaction to interaction (NurLutfiyana, 2018).

Based on the description above, material on class scheduling using the Particle Swarm Optimization Algorithm Method is expected to be useful and able to provide understanding and convenience to users in making class scheduling reports. By combining the Particle Swarm Optimization Algorithm Method into the class scheduling system at SMK Panca Budi 1 Medan, this system is used to produce class scheduling reports in an organized manner and does not cause clashes between teachers who teach in two majors.

Therefore, a class scheduling system was created at SMK Panca Budi 1 Medan using the PSO algorithm method to avoid clashes with teachers who teach in two departments.

2. RESEARCH METHOD

The research methodology used in this study is as follows:

a. Problem Formulation

The formulation of the problem is carried out by looking for problems contained in the process of the class scheduling system at SMK Panca Budi 1 Medan, which so far still uses manual methods, so that a better system is needed.

b. Goal Setting
Setting goals comes after the problem formulation stage. The results of the problem formulation stage are used as a guide for setting goals, which makes the scheduling system at SMK Panca Budi 1 Medan work better and more efficiently..

c. Studi Pustaka
Data collection using written sources involves reading, studying, and recording important things related to the problem being discussed in order to obtain a theoretical picture.

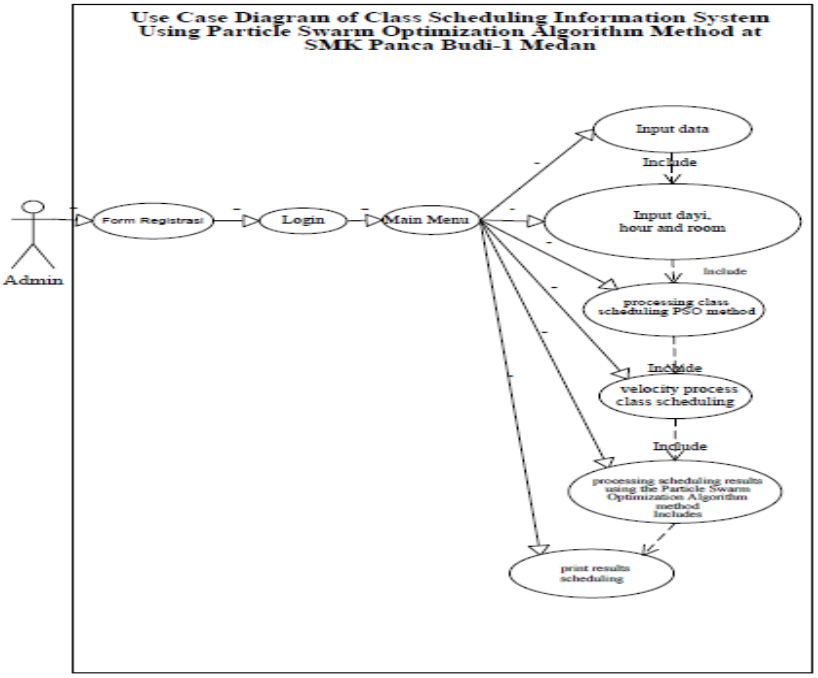
d. Data Collection
The data collection stage is carried out in order to obtain accurate data before carrying out the next stage. Data collection is carried out in two stages, namely system analysis that runs and system analysis needed to solve problems in the scheduling system at SMK Panca Budi 1 Medan.

e. System Implementation
The implementation stage is the application at the design stage in building the system.

f. System Testing
The system built in the implementation phase will be tested at this stage in order to answer the problems and produce solutions for this research.

3. RESULTS AND DISCUSSIONS

In the application of the particle swarm optimization algorithm in the scheduling information system at SMK Panca Budi 1 Medan, the author uses the Microsoft Visual Studio programming language and the SQL Server 2008 database. The class scheduling information system with the Particle Swarm Optimization Algorithm Method is one of the tools that is believed to be able to make a positive contribution to schools. In the user application, there is only one account, namely admin. The use case diagram of the application of the particle swarm optimization algorithm in the scheduling information system at SMK Panca Budi 1 Medan can be seen below:



Picture. 1 Use Case Diagram of Classroom Scheduling Information System

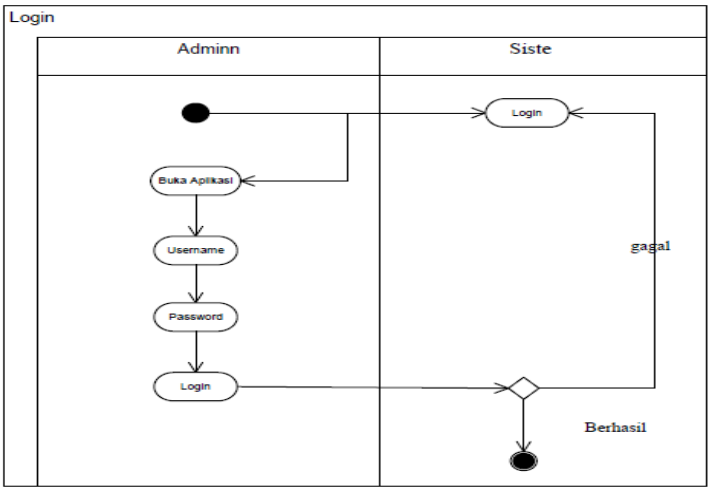
A. Activity Diagram

Activity diagrams illustrate the various activity flows in the system being designed, how each flow begins, the possible decisions, and how it ends. The following is an activity diagram of the application of the particle swarm optimization algorithm in the class scheduling information system of SMK Panca Budi 1 Medan:

1) Activity Diagram Login

Activity login diagram is an activity diagram for the login process.

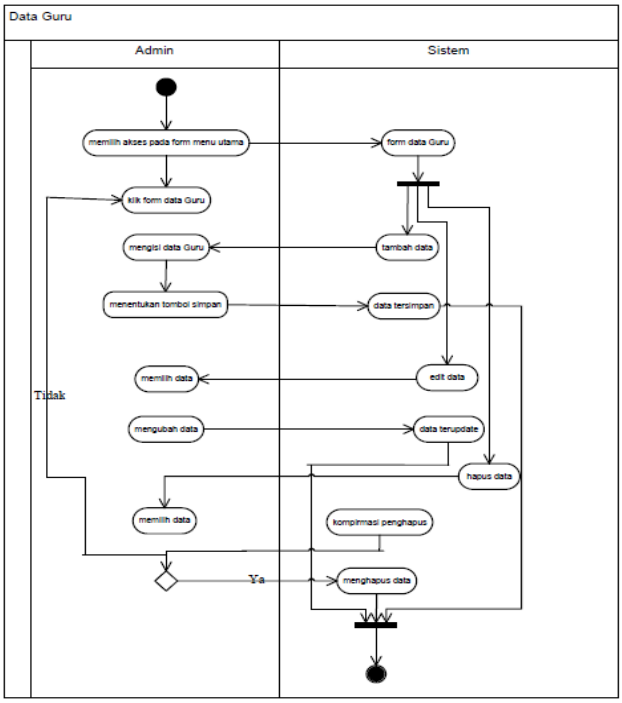
Table. 1 Activity Diagram Login



2) Activity Diagram Teacher Data

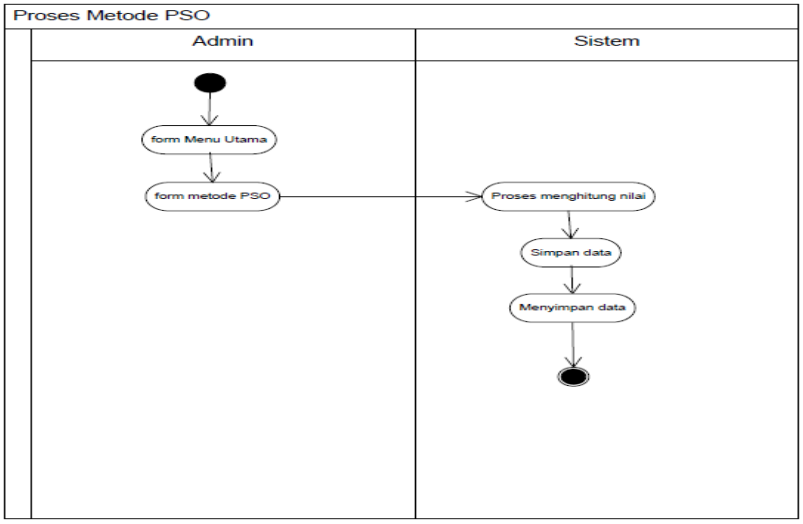
Teacher data diagram activity is an activity diagram for the process of adding, changing and deleting data in teacher data

Table. 2 Activity Diagram Teacher Data



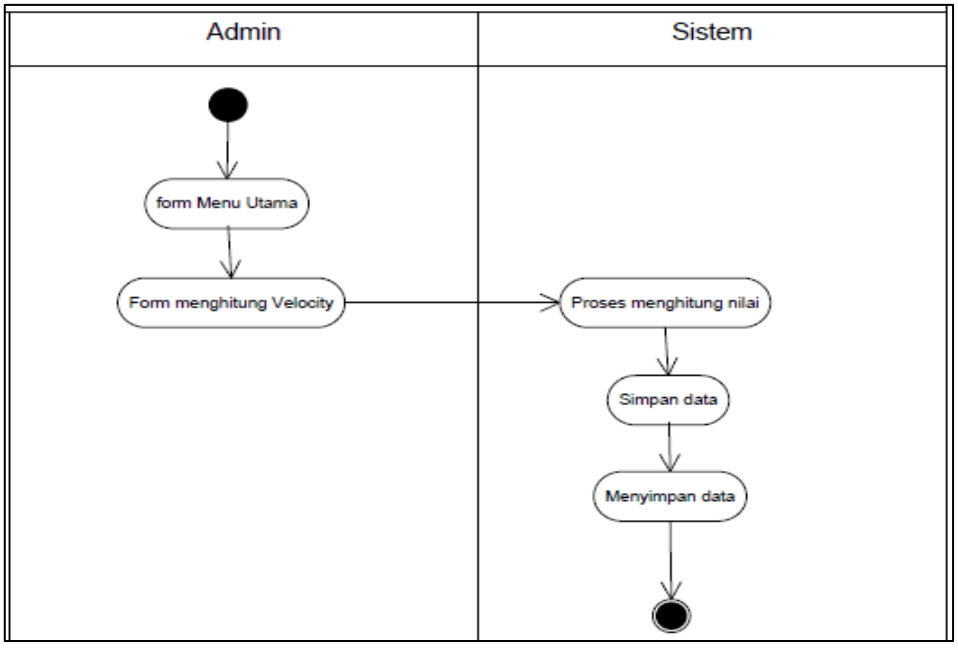
3) Activity Diagram Process Class Scheduling Method
Activity diagram, process method The PSO scheduling class is an activity diagram for the activity calculation process.

Table. 3 Activity Diagram Process Class Scheduling Method



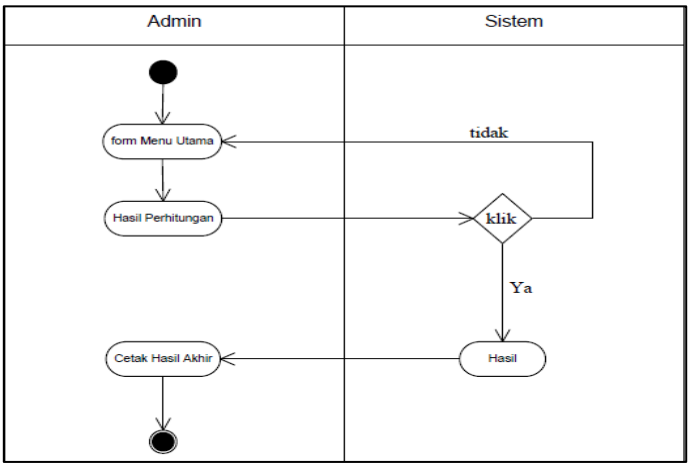
4) Activity Diagram Calculation Velocity
This activity diagram is an activity diagram for the velocity calculation process in the PSO method.

Table. 4 Activity Diagram Calculation Velocity



5) Activity Diagram Final Result
The final result activity diagram is an activity diagram for the viewing process scheduling result data.

Table. 5 Activity Diagram Final Results

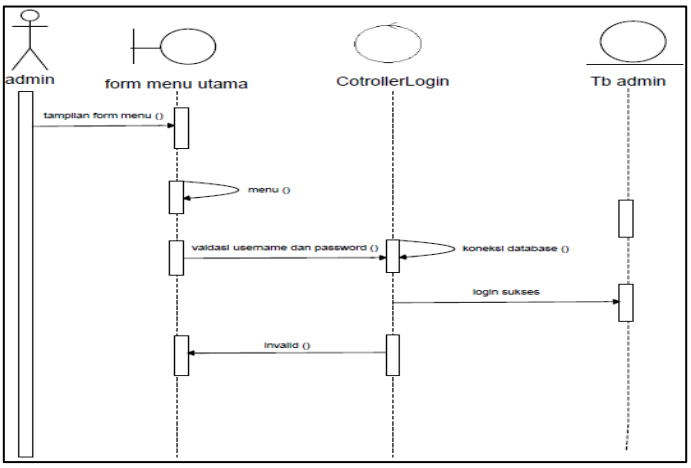


B. Diagram Sequence

The following are some sequence diagrams of the application of particle swarm optimization algorithms in the class scheduling information system of SMK Panca Budi 1 Medan:

1) Diagram Sequence Login

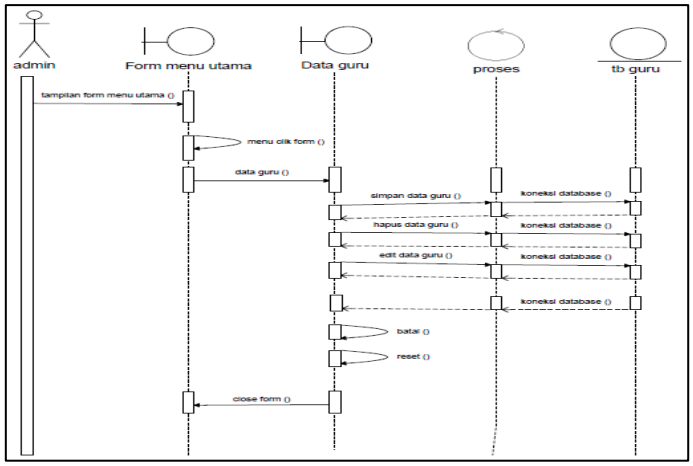
The login diagram sequence process is that the user enters a username and password on the login form. From the login form, the data will be sent to the system to check its availability. If the data is valid, the main page form will be displayed.



Picture. 2 Diagram Sequence Login

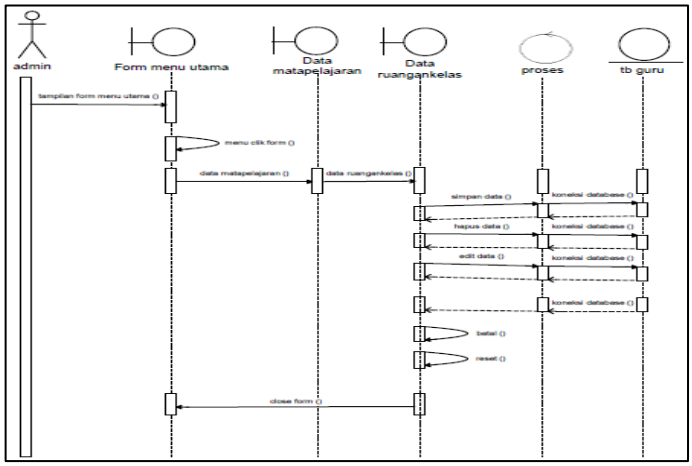
2) Diagram Sequence Teacher Data

This sequence diagram shows the process of processing teacher data; namely, users must fill out the forms for adding teacher data, changing teacher data, and deleting teacher data. Then the data will be sent to the system to be stored in the database.



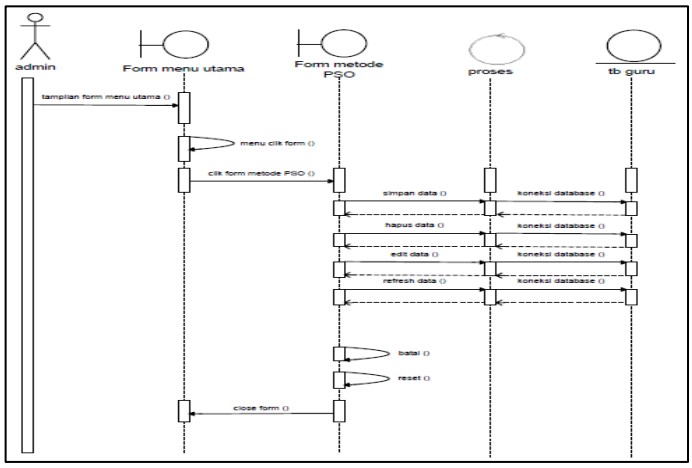
Picture. 3 Diagram Sequence Teacher Data

3) Day, Hour, and Room Data Sequence Diagram
This sequence diagram is the process of processing subject and classroom data, where users must fill out forms to add subject and classroom data, change subject and classroom data, and delete subject and classroom data. Then the data will be sent to the system to be stored in the database.



Gambar. 4 Day, Hour, and Room Data Sequence Diagram

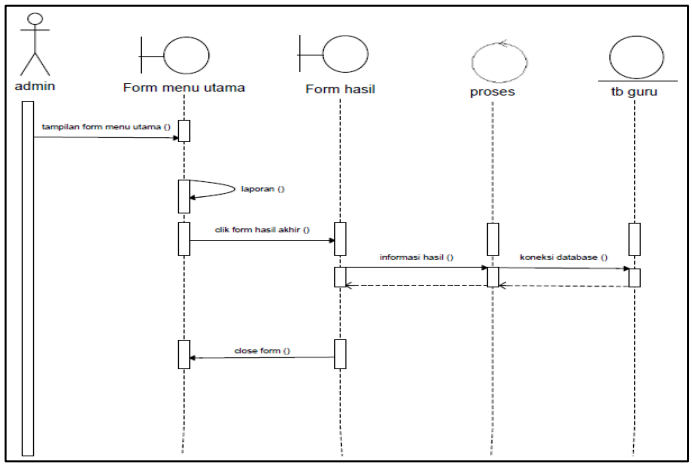
4) PSO Method Process Sequence Diagram
This diagram shows the process of processing teaching pso data; namely, users must fill out the form of adding teaching hour data, changing teaching hour data, and deleting teaching hour data. Then the data will be sent to the system to be stored in the database.



Picture. 5 PSO Method Process Sequence Diagram

5) Diagram Sequence Calculation Velocity
This diagram shows the process of processing velocity calculation data, where users must fill out the form for adding PSO method data, changing PSO method data, and deleting PSO method data. Then the data will be sent to the system to be stored in the database..

6) Diagram Sequence Final Result
This sequence diagram is the process of processing final result data, where users must fill out the form of adding final result data, changing the final result data, and deleting the final result data. Then the data will be sent to the system to be stored in the database.



Picture. 6 Final Results Sequence Diagram

C. Application Display

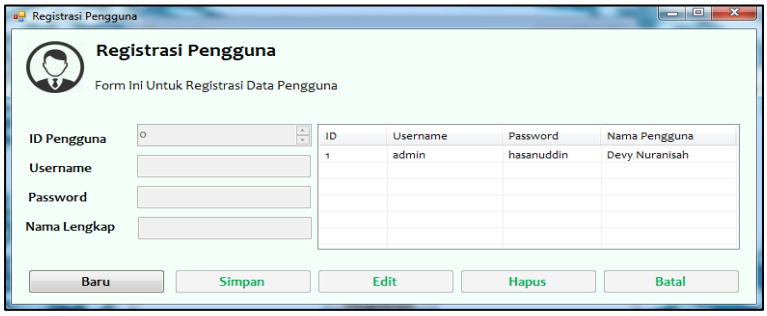
The following is explained about the display of results from the Class Scheduling Information System Using the Particle Swarm Optimization Algorithm Method at SMK Panca Budi 1 Medan, which can be seen as follows:

1) Login View
The login display is a login access for admins to enter the Class Scheduling Information System application using the Particle Swarm Optimization Algorithm Method at SMK Panca Budi – 1 Medan

Picture. 7 Display Login

Display of the user login system carried out by the admin and the registration button for admins who want to have a username and password.

2) Display of User Registration Form
The display of this form is to register, which functions as creating a user username and password account.

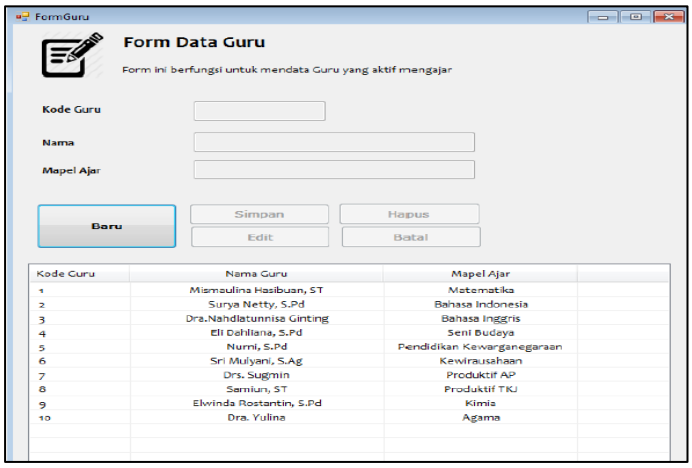


Picture. 8 Display Form List

3) Main Page Display
The display of the main page form system that functions to display file menu options, data menus, PSO menus, reports, and school photos is done by the user.

Picture. 9 Display Home

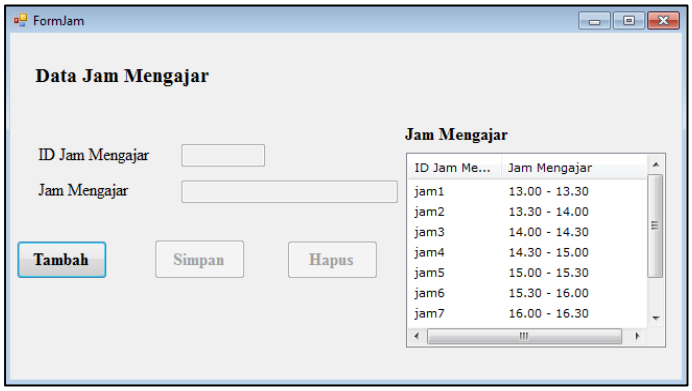
4) Teacher Data Form Display
Form display to process teacher data such as teacher code, teacher name, and subject that will be displayed on the list view and stored in the database.



Picture. 10 Teacher Data Form Display

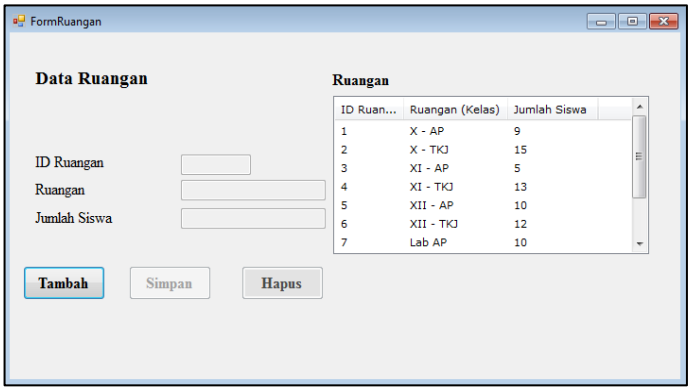
5) Day View
This form display serves to record days such as day and day ids shown in the image

6) Watch Face
This form display serves to collect hours, such as hour and hour IDs.



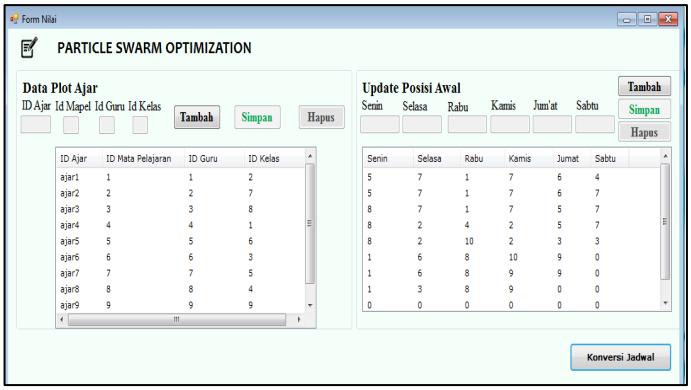
Picture. 11 Watch Faces

7) User Data View
User data display is a page that contains a table about user data information.



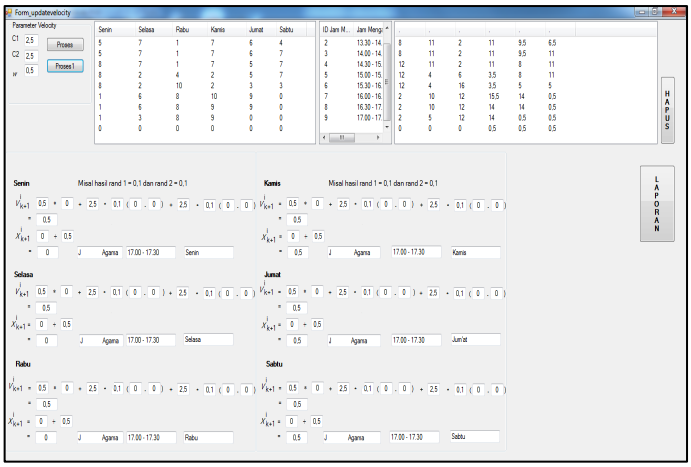
Picture. 12 User Data View

8) In the method PSO
This form display performs the calculation process using the Particle Swarm Optimization (PSO) method,



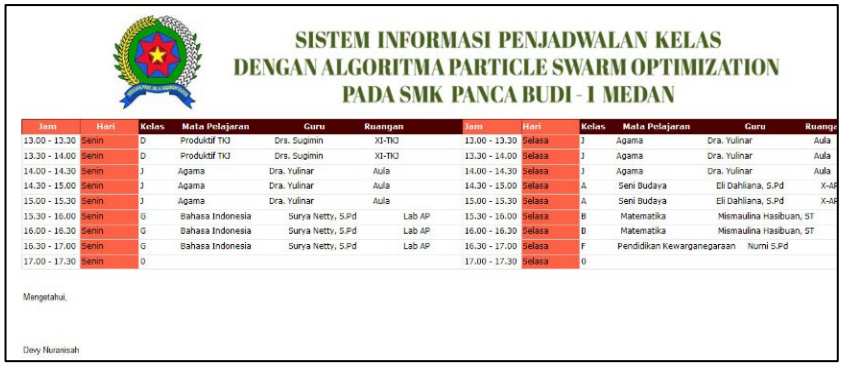
Picture. 13 PSO Methods

9) Performance Form Velocity
This form display performs velocity calculations using the Particle Swarm Optimization method



Gambar. 14 Performance Velocity

10) Report Form
Form display to see information about the report on the results of the department from each teacher.



Picture. 15 Reports

D. Discussion

The advantages of the Particle Swarm Optimization Algorithm Application System in the Class Scheduling Information System of SMK Panca Budi 1 Medan are:

1) The time required for the start-up process is relatively short.
2) The systems performance is relatively stable.
3) The system is able to produce information that is as expected.
4) The need for information on determining class scheduling will be much faster and more accurate.
5) The system is very fast in processing data to produce various information needed by users.

Meanwhile, the disadvantages of the Particle Swarm Optimization Algorithm Application System in the Class Scheduling Information System of SMK Panca Budi 1 Medan are:

1) The application does not support Android-based.
2) The massive system has not used the client server system and disseminated information.
3) System users still need a long time because system user experts still have to learn the system first before using it.
4) The system does not have automatic data backup to avoid the possibility of important data loss caused by hardware damage.
5) The presentation of the report is only limited to the highest final assessment of each class scheduling in Particle Swarm Optimization.

Based on the system test plan that has been prepared, the following tests can be carried out:

Table. 6 System Testing

Data test cases and results			
Test Scenarios	**Test Case**	**Expected results**	**Test Results**
Menu Login	• Button Login • Button Reset • Registration Button	• Login Button, The system will complete the username and password data with the data in the database, if the data matches then the system will display the main menu. • Button Reset, serves as a clean textbox to enter different usernames and passwords. • Registration button, a system that will take the user to the user registration form.	Valid
User Registration Form	• Button Baru • Add button • Button Edit • Button Batal	• New button, to fill in new user data and click the add button, the system will change the data when the user	Valid

Data test cases and results			
Test Scenarios	**Test Case**	**Expected results**	**Test Results**
		selects the data and clicks the edit button	
Form Data Guru	• Button Baru • Button Simpan • Button Edit • Happy Button • Button Batal	New button, to fill in the new teacher data and click the save button, the system will change the data when the user selects the data and clicks the edit button.	Valid
Form Data Hari	• Add button • Button Simpan • Happy Button	Add button to add day data and click save button to save day data.	Valid
Form Data Jam	• Add button • Button Simpan • Happy Button	Add button to add clock data and click save button to save clock data.	Valid
Room Data Form	• Add button • Button Simpan • Happy Button	Add button to add room data and click save button to save room data.	Valid
Form Method PSO	• Button Amount • Button Conversion Results • Happy Button	Amount button to display the amount of pso data, conversion result button to produce PSO calculation.	Valid
Form Velocity	• Button Proses • Button Proses1 • Happy Button	Process button to display values of c1, c2 and w. Process button1 to display velocity calculation results	Valid
Results Report Form	• Final result report	The system will perform a database connection to display information	Valid

Test results from blackbox testing that have been carried out show that the system built already meets the functional requirements. However, in the process, it is still possible for errors to occur. Functionally, the system that has been built can already produce the expected output.

4. CONCLUSION

Based on the results of research on the application of the particle swarm optimization algorithm in the class scheduling information system of SMK Panca Budi 1 Medan, the results are as follows:

a. The system design for the class scheduling system is faster and more accurate, so as to minimize delays in inputting data into scheduling classes at SMK Panca Budi - 1 Medan.
b. A system that can find out the schedule of classes at SMK Panca Budi - 1 Medan. quickly and efficiently.

c. A system that can later generate reports quickly and accurately will make it easier for teachers to see teaching schedules.

ACKNOWLEDGEMENTS

This research will not be completed without the help of various parties. Therefore, on this occasion, I would like to express my deepest gratitude to those who have provided guidance and direction that have been very useful to me in completing this research. I would also like to express my gratitude to my family and friends who have given her support and motivation. Only Allah Almighty can reward him.

REFERENCES

[1] Ade Maulana, Warno, Bambang Judi Bagiono, "Sistem Informasi Jasa Laundry Kiloan Menggunakan Program Visual Studio 2010", Jurnal VISUALISASI, STMIK Muhammadiyah Jakarta Vol.6, No.2, Oktober 2020, hlm.84-93 P-ISSN 2355-2468 E-ISSN 2745-584x.

[2] Baenil Huda, "Sistem Informasi Data Penduduk Berbasis Android Dan Web Monitoring Studi Kasus Pemerintah Kota Karawang " Jurnal Buana Ilmu Vol.3 No.1 November 2018 ISSN : 2541-6995.

[3] Fitri Ayu, Nia Permatasari, "Perancangan Sistem Informasi Pengolahan Data Praktek Kerja Lapangan (PKL) Pada Devisi Human PT.Pegadaian" ,Jurnal Intra-Tech Volume 2, No.2 Oktober 2018 ISSN. 2549-0222.

[4] Hamid Kurniawan, Dede Firmansyah, Widya Apriliah, Ilham Kurniawan, "Penerapan Metode Waterfall Dalam Perancangan Sistem Informasi Pengajian Pada SMK Bina Karya Karawang", Jurnal Interkom Vol.14, No.4 Januari 2020.

[5] Helmi Fauzi Siregar, Yusnita Handika Siregar, Melani, "Perancangan Aplikasi Komik Hadist Berbasis Multimedia", Jurnal Teknologi Informasi V0l.2, No.2. Desember 2018. P-ISSN 2580-7927 E-ISSN 2615-2738.

[6] Irfrans Kusmarna, Luh Kesuma Wardhani, Muhammad Safrizal, "Aplikasi Penjadwalan Mata Kuliah Menggunakan Algoritma Particle Swarm Optimization (PSO)", Jurnal Teknik Informatika Vol.8 No.2 Bulan Oktober 2015.

[7] Nofyat, Adelina Ibrahim, Arisandy Ambarita, "Sistem Informasi Pengaduan Air Berbasis Website Pada PDAM Kota Ternate", Indonesia Journal on Information System e-ISSN 2548-6438 p-ISSN 2614-7173.

[8] Nur Lutfiyana "Penerapan Algoritma C4.5 Berbasis Particle Swarm Optimization Untuk Prediksi Hasil Layanan Kemudian Donasi Zakat Dan Program",Jurnal PILAR Nusa Mandiri Vol.14, No.1 Maret 2018, P-ISSN: 1978-1946, E-ISSN: 2527-6514.

[9] Sarmidi, Sidik Ibnu Rahmat, "Sistem Peringatan Dini Banjir Menggunakan Sensor Ultrasonik Berbasis Arduino UNO", JUMANTAKA Vol 02 No 01 (2019) PISSN: 2613-9138 ISSN: 2613-9146.

[10] Suci Ayu Mawarni, Zarnelly, Arif Marsal "Sistem Informasi Penjadwalan Ceramah Menggunakan Algoritma Greedy", Jurnal Ilmiah Rekayasa dan Manajemen Sistem Informasi, Vol.5, No.1, Februari 2019, Hal 109-118. e-ISSN 2502-8995 p-ISSN 2460-8181.

[11] Surtika Ayumida, Mohammad Syamsul Azis, Zulfirman Gherar Fiano, "Implementasi Program Administrasi Pembayaran Berbasis Dekstop (Studi Kasus: SMA Negeri 1 Cikampek)", JURNAL INTERKOM Volume 15, No.2-Juli 2020.

[12] Ujang Juhardi, Andilala, "Optimalisasi Penjualan Motor Menggunakan Algoritma Particle Swarm Optimization (PSO)" Jurnal Media Infotama Vol.15 No.2, September 2019 ISSN 1858-2680.

[13] Widia Hapnita, Rijal Abdullah, Yuwalitas Gusmareta, Fahmi Rizal, "Faktor Internal Dan Ekasternal Yang Dominan Mempengaruhi Hasil Belajar Menggambar Dengan Perangkat Lunak Siswa Kelas XI Teknik Gambar Bangunan SMK N 1 Padang Tahun 2016/2017 ", CIVED JURUSAN TEKNIK SIPIL, Vol.5 No.1, Maret 2018. ISSN 2302-3411.