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THE USE OF GENETIC ALGORITHM IN DETERMINING EMPLOYEE SCHEDULES AT PLN ULP OFFICE SELATAN

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ABSTRACT

The current Covid 19 that is hitting the world has forced an agency, especially at the South Medan PLN ULP Office, to make every effort to process all work more quickly and be careful at work. The process of preparing the shift schedule at the PLN Medan Selatan ULP Office which is currently running is still using Microsoft Excel (Fahrezi 2022). Sometimes with a process like this, there are still frequent clashes between one schedule and another, making the performance at the agency less than optimal (Dwi Oktarina 2019). To overcome this, there are several ways or methods used in scheduling, one of which is by using genetic algorithms. A genetic algorithm is an algorithm that seeks to apply scientific evolutionary understanding to solving problems involving different types of parent chromosomes and the formation of new chromosomes. The ability of a stronger individual will be higher than that of a weaker individual and the results of this study have succeeded in making a scheduling application at PLN Medan Selatan which is useful for helping companies improve the efficiency of employee performance at PLN Medan Selatan.

Keyword : PLN, Genetics, Schedule

1.   INTRODUCTION

The rapid development of this information technology has entered almost every area of life, which is found by the many users of computers and other digital devices, both for the benefit of an agency and to support its business, or just for daily entertainment (Sundari 2021). This development is supported by the growth of the computer hardware and software industry, and all of this has had a number of positive impacts on life. Covid 19, which is currently sweeping the world, has forced an agency, especially at the South Medan PLN ULP Office, to make every effort to process all work more quickly and carefully at work. the process of preparing a shift schedule at the South Medan PLN ULP Office which is currently underway is still using Microsoft Excel (Fahrezi 2022). Sometimes with a process like this there are still frequent clashes between one schedule and another, making performance at the agency less than optimal (Dwi Oktarina 2019). To overcome this, in scheduling there are several ways or methods used, one of which is by using a genetic algorithm. This algorithm is an algorithm that can be used to generate scheduling results according to the existing input. From this algorithm itself, it will produce fast results in the process of generating employee shift scheduling at the ULP PLN Medan Selatan Office (Dwi Oktarina 2019). A genetic algorithm is an algorithm that seeks to apply scientific evolutionary understanding to solve problems that have different types of parental chromosomes as well as the formation of new chromosomes. The abilities of stronger individuals will be higher than those of weaker individuals (Sari et al. 2019). The parent and child chromosomes of the application represent the solution to be made, so that the adaptation of the genetic algorithm allows the best solution to be maintained. Due to the unique nature of the genetic algorithm, the genetic algorithm can be used to find an appropriate schedule based on the problem of scheduling worker shifts during the COVID-19 pandemic (Ridwan 2016).

Algorithm can be interpreted as a series of logical and systematic steps in finding a solution to an existing problem. The algorithm has 5 sequence components, namely finiteness (limited), definiteness (certainty), input (input), output (output), and effectiveness (effectiveness) (Sudibyo et al. 2020)..

2. RESEARCH METHOD
2.1 Genetic Algotirthm Implementation
The input data needed by the system to perform scheduling optimization are employee data, day data, and shift data. From the lesson schedule data must be encoded first, encoding needs to be done to change the form of the original data into data that can be processed by the Genetic Algorithm. Data encoding is done to create data with a unique code that represents all data assignments. From the data encoding with this unique code, the process of forming chromosomes as elements in the Genetic Algorithm can then be carried out. In addition to scheduling data, the system also requires input in the form of Genetic Algorithm parameters, namely population size, maximum iteration or number of generations, Crossover Rate (Cr) and Mutaion Rate (Mr) values. The data from the encoding results are then searched for a solution using the Genetic Algorithm according to the parameters of the Genetic Algorithm that have been entered. In the process of finding a solution, the fitness value of each generation will be sought. The highest fitness value indicates the better the resulting solution.

2.2 Chromosom Represntation
Chromosomal representation is a form of coding for the genes that make up the chromosomes. The gene to be built in the chromosome representation is an integer number which is a unique code. The length of the chromosome is as long as the amount of data in the assignment of employees

Table. 1 Employee Table

Kode	Mata Pelajaran
1	Zulham Efendi
2	Raja Amru Hasibuan
3	Rizka Zulkarnain
4	Vivi Rahmadani
5	Muhammad Fikri

2.3 Population Set
Populasi ini dibuat untuk membangkitkan individu sebanyak jumlah populasi yang telah ditentukan sebelumnya. Kromosom dibangkitkan sebanyak jumlah solusi yaitu sebanyak jumlah hari sebanyak 6 buah kromosom. Bangkitkan gen untuk masing-masing kromosom dengan jumlah gen sebanyak 5 buah gen yang terdiri dari gen jam mata pelajaran.

1. Chromosom Representation

Hari		Employee				
		1	2	3	4	5
	1	5	2	21	1	35
	2	22	16	23	3	24
	3	9	15	7	8	32
	4	1	3	6	19	34
	5	17	14	11	0	33
	6	4	11	20	8	12

2. Random Number Generator

Hari		Employee				
		1	2	3	4	5
	1	3	31	5	5	1
	2	9	14	11	7	7
	3	16	16	3	11	24
	4	3	3	1	19	14
	5	6	4	23	23	19
	6	21	21	22	1	2

2.4 Fitness Value
Individu-individu dalam populasi telah terbentuk, langkah selanjutnya akan menghitung nilai fitness dari setiap individu yang ada. Fitness akan dihitung berdasarkan jumlah pelanggaran yang terjadi pada setiap slot kromosom dalam satu individu. Berikut adalah rumus perhitungan fungsi fitness :

$$f(g) = \frac{1}{\sum(x)} fi$$

Dimana :
F (g) = Fungsi fitness
Fi = Nilai fitness individu ke i
X = Total dari kemunculan nomor double

Contoh perhitungan nilai fitness :

$$f(g) = \frac{1}{\sum(x)} f_1$$
$$f(g) = \frac{1}{\sum(6)} 3$$
$$f(g) = 0,500$$

| 0,500 | 5,166 | 0,833 | 0,833 | 0,166 |

Total = 7,498

3.5.4 Proses Seleksi

Pada seleksi ini individu dipilih berdasarkan nilai fitness mereka untuk memilih individu mana yang akan mengalami proses perkawinan atau pindah silang, lebih baik kualitas suatu individu akan lebih besar peluangnya untuk terpilih. Proses ini akan dihitung nilai kumulatif dari probabilitas fitness masing-masing individu. Berikut adalah rumus probabilitas fitness :

$$Pi = \frac{fi}{N}$$

Dimana :
Pi = Probabilitas fitness ke-i
Fi = Nilai fitness individu ke-i
N = Jumlah kromosom

Contoh perhitungan probabilitas fitness :

$$P_1 = \frac{f_1}{N}$$
$$P_1 = \frac{0,500}{7,498}$$
$$P_1 = 0,066$$

3.5.5 Proses *Crossover*

Reproduksi menggunakan proses *crossover* dilakukan dengan cara menukarkan susunan kromosom dari 2 induk yang terpilih yang kemudian dihasilkan individu baru dari hasil reproduksi *crossover*. *Crossover* yang dilakukan dalam penelitian ini menggunakan metode *onecut-point crossover* yaitu dengan cara mengambil beberapa gen dari induk pertama yang kemudian digabungkan dengan gen pada induk kedua. Selanjutnya ditentukan titik potong gen pada kromosom secara acak. Titik potong tersebut digunakan sebagai titik pertukaran gen yang akan dilakukan dalam dalam proses *crossover*.

Parents 1 :

Pegawai					
		1	2	3	4	5
Hari	1	5	2	21	1	35
	2	22	16	23	3	24
	3	9	15	7	8	32
	4	1	3	6	19	34
	5	17	14	11	0	33
	6	4	11	20	8	12

Parents 2 :

Pegawai

Multimedia based tenses learning media Interactive using the addie method (Qodri Hariansyah)

		1	2	3	4	5
Hari	1	3	31	5	5	1
	2	9	14	11	7	7
	3	16	16	3	11	24
	4	3	3	1	19	14
	5	6	4	23	23	19
	6	21	21	22	1	2

Fase ini adalah fase yang paling signifikan dalam tahapan algoritma genetika. Untuk setiap pasangan parents yang akan dikawinkan, sebuah *crossover point* dipilih secara acak diantara gen. sebagai contoh misalnya *crossover point* adalah 3 seperti berikut :

Child 1 :

Pegawai						
		1	2	3	4	5
Hari	1	5	2	21	1	35
	2	22	16	23	3	24
	3	9	15	7	8	32
	4	3	3	1	19	14
	5	6	4	23	23	19
	6	21	21	22	1	2

Child 2 :

Pegawai						
		1	2	3	4	5
Hari	1	3	31	5	5	1
	2	9	14	11	7	7
	3	16	16	3	11	24
	4	1	3	6	19	34
	5	17	14	11	0	33
	6	4	11	20	8	12

2.5 Mutation Process

Mutasi merupakan operator dalam algoritma genetika yang bertujuan untuk mengubah gen-gen tertentu yang terdapat dalam sebuah kromosom. Pada penelitian ini proses mutasi yang digunakan adalah skema *swap mutation*.

Jumlah kromosom yang mengalami mutasi dalam satu populasi ditentukan oleh parameter probabilitas mutasi. Proses mutasi sebagai berikut :

1. Hitung jumlah gen yang ada dalam populasi.
    Jumlah gen = jlh individu × banyak gen dalam individu
    Jumlah gen = 6 × 5
    Jumlah gen = 30
2. Hitung jumlah gen yang akan mengalami mutasi dengan parameter probabilitas mutasi yang telah ditentukan sebelumnya, misalnya probabilitas mutasi atau Pm 20%, maka :
    Pm = Jumlah % × Jumlah gen
    Pm = 20 % × 30
    Pm = 6 (jlh gen yang dimutasi)
    Kromosom sebelum mutasi hasil dari crossover child 1 :

Pegawai						
		1	2	3	4	5
Hari	1	5	2	21	1	35
	2	22	16	23	3	24
	3	9	15	7	8	32

	4	3	3	1	19	14
	5	6	4	23	23	19
	6	21	21	22	1	2

Kromosom setelah mutasi :

		Pegawai				
		1	2	3	4	5
Hari	1	5	2	9	1	35
	2	22	16	23	3	24
	3	9	15	7	8	32
	4	3	3	1	19	14
	5	6	4	23	23	19
	6	21	21	22	1	2

Tahap mutasi dilakukan untuk menjaga keberagaman diantara populasi dan mencegah korvengensi premature (*over estimation*).

2.3 Research Design
In the system research design, there is a research design that functions as the stages in developing tenses learning media. The research design made by the author can be seen in Figure below.
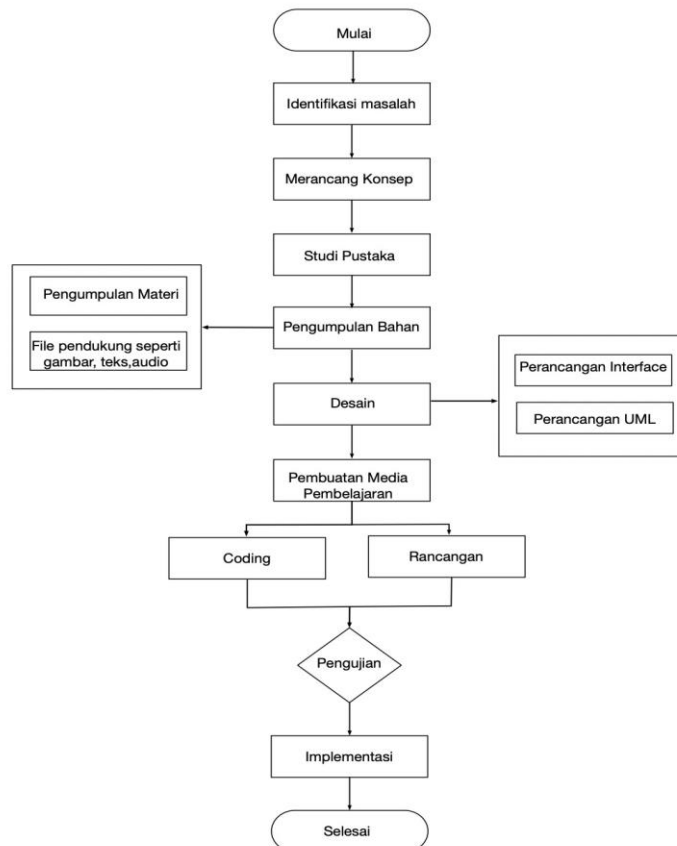
Figure 1. Research Design

2.3 Problem Statement
After observing the current tenses learning, many teachers do face-to-face tenses learning by the teacher, causing boredom in doing tenses learning. then the author tries to implement the tenses learning application in English.

3.   RESULT AND DISCUSSION

3.1 Result

Setelah penelitian ini dilaksanakan maka tahap selanjutnya adalah menunjukkan hasil penelitian dan melakukan pengujian sistem. Sistem yang telah selesai dirancang terdiri dari beberapa halaman yang memiliki fungsi masing-masing. Adapun halaman yang akan di tampilkan sebagai berikut

1. *Login*

This page displays the initial display which is for users to log in to the system. The appearance is as follows:

Fig 1. Login Page

2. Dashboard Admin

This page is used by the admin to access various menus available in the system. The appearance is as follows:
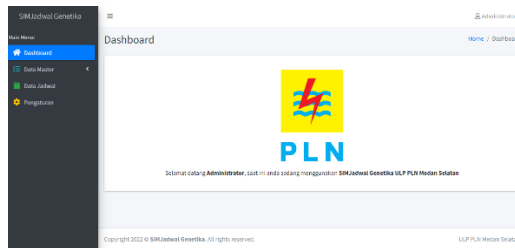
Fig. 2 Admin Dashboard

3. User Data

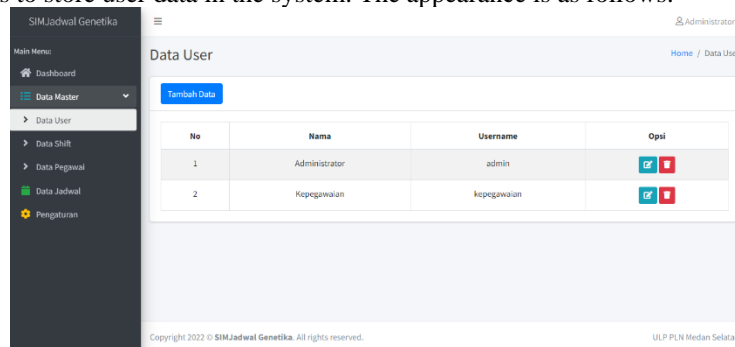This safe function is to store user data in the system. The appearance is as follows:

Fig 3.User Data Page

4. Employee Page

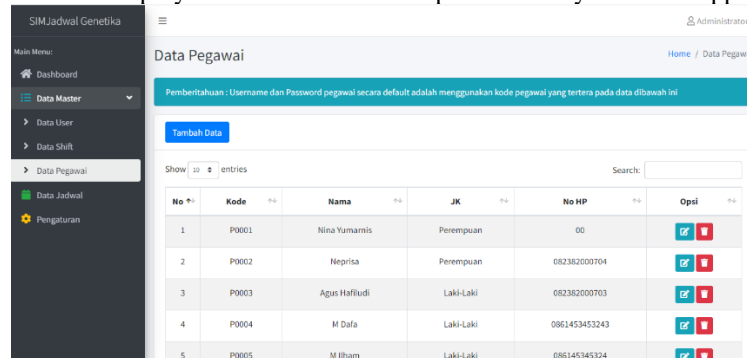This page functions to store employee data that has been input into the system. The appearance is as follows:

Fig 4. Employee Page

5. Emploeyee Dashboard

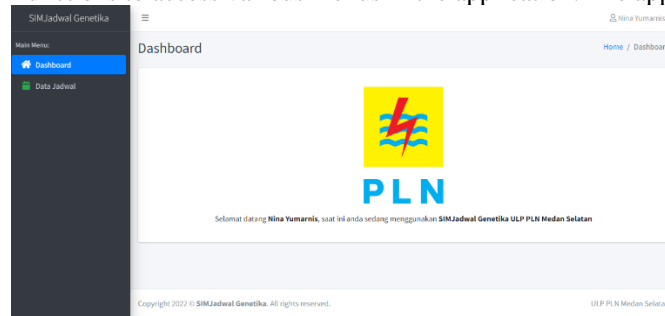On this page, the admin functions to access various menus in the application. The appearance is as follows:

Fig 5. Employee Dashboard

4. CONCLUSION

The conclusions of this study are:
1. Researchers have succeeded in making a scheduling application at PLN Medan Selatan which has uses to assist companies in increasing the efficiency of employee performance at PLN Medan Selatan.
2. This research succeeded in solving existing problems, especially in job scheduling and can be accessed by the admin and PLN Medan Selatan employees.
3. Applications built using the web using the web programming language and mysql database.
4. The genetic algorithm has been successfully applied to the scheduling application at PLN Medan Selatan and can run normally

REFERENCES

Anggi Andriyadi, H. (2022). Optimasi Algoritma Genetika dalam Perancangan Sistem Informasi Penjadwalan Seminar dan Sidang Skripsi Mahasiswa Institut Informatika dan Bisnis (IIB) Darmajaya. 16(01), 133–140.

arif budiman, alhamidi, eka iswandy. (2022). Perancangan Sistem Informasi Penjadwalan Produksi Pada Toko Perabot Arif. 08, 9–15.

Dwi Oktarina, alyauma H. (2019). PERANCANGAN SISTEM PENJADWALAN SEMINAR PROPOSAL DAN. 3(1).

Hatta, M., Anwar, M. M., Diana, I. N., & Amarul M, M. H. (2019). Perancangan Sistem Informasi Pengarsipan Dan Disposisi Surat Berbasis Web Dengan Menggunakan Framework Codeigniter. SCAN - Jurnal Teknologi Informasi Dan Komunikasi, 14(2). https://doi.org/10.33005/scan.v14i2.1481

Misdram, M., & Abidin, Z. (2018). Implementasi integrasi desktop dan website sistem informasi service komputer pada Karisma Computer Pasuruan menggunakan remote mysql. Spirit, 10(2), 72–86.

Mubarak, A. (2019). Rancang Bangun Aplikasi Web Sekolah Menggunakan Uml (Unified Modeling Language) Dan Bahasa Pemrograman Php (Php Hypertext Preprocessor) Berorientasi Objek. JIKO (Jurnal Informatika Dan Komputer), 2(1), 19–25. https://doi.org/10.33387/jiko.v2i1.1052

Rahmatullah, A. F., & Ropianto, M. (2017). Aplikasi pengorderan Gas pada PT Amartha Anugrah Mandiri Batam Berbasis MySQL. 1–6.

Sari, Y., Alkaff, M., Wijaya, E. S., Soraya, S., Kartikasari, D. P., Studi, P., Informasi, T., Mangkurat, U. L., Studi, P., Informasi, T., & Brawijaya, U. (2019). Optimasi penjadwalan mata kuliah menggunakan metode algoritma genetika dengan teknik tournament selection. 6(1), 85–92. https://doi.org/10.25126/jtiik.201961262

Suendri. (2018). Implementasi Diagram UML (Unified Modelling Language) Pada Perancangan Sistem Informasi Remunerasi Dosen Dengan Database Oracle (Studi Kasus: UIN Sumatera Utara Medan). Jurnal Ilmu Komputer Dan Informatika, 3(1), 1–9. http://jurnal.uinsu.ac.id/index.php/algoritma/article/download/3148/1871

Susilo, M. (2018). Rancang Bangun Website Toko Online Menggunakan Metode Waterfall. InfoTekJar (Jurnal Nasional Informatika Dan Teknologi Jaringan), 2(2), 98–105. https://doi.org/10.30743/infotekjar.v2i2.171

Syahrul, S. R., & Desmulyati. (2019). Perancangan Website Sistem Informasi Simpanpinjam Menggunakan Framework Codeiginter Pada Koperasi Bumi Sejahtera Jakarta. PERANCANGAN WEBSITE SISTEM INFORMASI SIMPAN PINJAM MENGGUNAKAN FRAMEWORK CODEIGINTER PADA

KOPERASI BUMI ISSN : 2579-5201 (Printed) PERANCANGAN SEJAHTERA JAKARTA Syahrul, 3(1), 21–28.

Tabrani, M. (2018). Penerapan Metode Waterfall Pada Sistem Informasi Inventori Pt. Pangan Sehat Sejahtera. Jurnal Inkofar, 1(2), 30–40. https://doi.org/10.46846/jurnalinkofar.v1i2.12