



DESIGN AND BUILD SCHEDULING INFORMATION SYSTEM FOR RSUD DR. RM. DJOELHAM

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Abstract

Hospitals are institutions that provide complete individual health services, which provide facilities in the form of inpatient, outpatient and emergency services. Currently scheduling at RSUD Dr. RM. Djoelham has constraints related to service management that is not optimal, causing delays, this is related to an erratic schedule that makes shift changes that occur not optimal. Genetic algorithms can be used to help schedule employees RSUD Dr. RM. Djoelham automatically. Scheduling automation can be accomplished by properly coding into chromosomes. To realize the management information system RSUD Dr. RM. Djoelham can use the PHP CodeIgniter framework. The purpose of designing a management information system at the hospital is expected to facilitate data collection on employee schedules and speed up schedule data collection. And can minimize the possibility of errors that occur during the scheduling process. The results of this study the system can schedule automatically, making schedules can also be done for each division. Functional testing is carried out using a black box where the test results show that all features can run as they should.



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I. INTRODUCTION

Along with the times, information technology has transformed into something that is needed today. In several aspects of life, such as the economy, education, health, and so on, various information technologies have been widely used[1]. One that uses Information Technology to carry out daily work is the Hospital. Hospitals are institutions that provide complete individual health services, which provide facilities in the form of inpatient, outpatient

and emergency services. So from the definition above it can be concluded that the hospital is a health service institution for the community with its own characteristics that are influenced by the development of health science, technological advances, and the socio-economic life of the community[2]. RSUD Dr. RM. Djoelham is a regional general hospital located at Jalan Jenderal Gatot Subroto No.9, Satria, Binjai

City, North Sumatra. This hospital has three main divisions that play an active role in the continuity process, namely the Services Division, the General Affairs & HR Division, and the Finance Division. The service division itself has three sub-divisions, namely medical services, medical support, and nursing.

One of the tasks of the Hospital Service Division Dr. RM. Djoelham namely time management or scheduling which is a form of managing time with the aim of assisting employee activities in providing health services to patients, so that the patient service process can take place smoothly. The employee scheduling system at the hospital is very important, because it is the operational standard used by the workforce in carrying out the work that has been determined. In making the schedule, it is necessary to pay attention, because this relates to various criteria

that must be met so that these activities can take place regularly and neatly.

The scheduling of the RM Djoelham Hospital is currently regulated by the Nursing Department. The Nursing Section is led by the Section Head who, in carrying out his duties, is under and responsible to the Deputy Director of Services. To carry out their duties, the Head of the Nursing Department has the function of compiling a work plan program, carrying out the management of Nursing administrative matters, managing Nursing data, planning employee needs, and other tasks assigned by the Deputy Director of Services in accordance with their field of work. The Nursing Division consists of the Nursing/Midwifery Care Sub-Sector, the Profession/Nursing HR Sub-Sector, and the Nursing Logistics Sub-Sector.

At DR. RM. Djoelham has problems in managing employee scheduling, such as setting shift schedules for hospital employees who are uncertain, and the scheduling process at the hospital is still done manually and still uses paper. This causes problems such as conflicting schedules so that work efficiency is not optimal, the process of making scheduling reports is time consuming, and several other things that become problems. Currently, there is still no system that can record DR employee schedule data. RM. Djoelham quickly, practically and easily. One of the impacts of problems related to scheduling is that it will affect company productivity.

With the scheduling problem, it will be discussed how to solve the problem that occurs with an approach that is using a genetic algorithm. Genetic algorithms apply the understanding of natural evolution to problem solving. The approach taken in the genetic algorithm is to randomly collect the various solutions selected in the set to get the best solution, which is when it maximizes the match which is called the fitness value. The selected generation is the generation that represents an update to the previous population or group. By going through an iterative process, this algorithm can get the most appropriate solution for the problem at hand[3]. There are several advantages to using a genetic algorithm such as not using a lot of mathematical requirements in completing the process, the evolution operation of the algorithm is very effective in observing random global positions, the flexibility in the algorithm can be implemented efficiently on certain problems[4].

Management information system design on HOSPITAL. Dr. RM. Djoelham by implementing codeigniter. CI has a complete library for carrying out operations commonly required by web-based applications, for example accessing databases, validating forms so that the developed system is easy[5]. CodeIgniter can also make it easier for developers to create PHP-based web applications, because the framework already has a framework so there is no need to write all the program code from scratch.

The different between this research scheduling system with others is each division can making their own schedule and leave feature where employees can apply for leave, then the admin will do the approval.

II. LITERATURE

2.1. Hospital, Outpatient and Inpatient

Hospitals are institutions that provide complete individual health services, which provide facilities in the form of inpatient, outpatient and emergency services. Hospitalization is a form of medical benefit for the care, treatment, or rehabilitation process of sick patients, who must be hospitalized for at least one day. Outpatient services are one of the facilities provided by the hospital to patients, where patients receive services in the form of observation, diagnosis, treatment, rehabilitation and other health services without having to stay overnight and can go home on the same day[2].

The hospital is a health service institution that organizes individual health services in a complete manner that provides inpatient, outpatient and emergency services. One indicator of the success of health services in the community is quality health services. The provision of health services by hospitals experiences dynamics in accordance with the development of society, developments in science and technology in the field of health and medicine[3].

2.2. Genetic Algorithm

Genetic Algorithm is a computer program designed to provide a solution based on a specified fitness function for any problem in the form of adaptation (natural or artificial) using natural genetic methods[6]. This method can work with a population consisting of several individuals, each of which can be represented as a solution to a possible problem. in making the process as well as the terminology or terms used. The terms used can be seen from the following table:

Table 1. Genetic Algorithm

N o	Genetic Algorithm	Explanation	Definition
1	Chromosomes (String, Individual)	Solution (coding)	Structures that encode prescriptions that specify how organisms are constructed
2	Genes (bits)	Part of the solution	The part of a chromosome that is made up of a number of individual structures
3	Locus	Position of Gen	
4	Alleles	Gene Value	

In the Genetic Algorithm there are several definitions, most of which are taken from genetic

terminology to mean the parts of the problem that exist and the following are the following terms[7]:

1. Genotype (gene), is a value that is used as a basic unit that forms a certain meaning in a unit of genes called chromosomes. This gene can be a binary, float, integer or character value, or combinatorial.
2. Allele is the value of the gene
3. Chromosomes are a certain value that comes from a combination of several genes.
4. Individuals can be said to be the same as chromosomes, which means that one of the possible solutions comes from the problem raised and expressed as a value or state.
5. The population is a group of individuals who will be processed together in one cycle of the evolutionary process.
6. Generation states a unit cycle of the evolutionary process in which the initial population is built randomly while the next population is the result of the evolution of chromosomes through iterations.
7. Fitness value, states how well the value of an individual or solution is obtained. This fitness value is used as a reference in achieving the optimal value in the genetic algorithm. The genetic algorithm aims to find individuals with the highest fitness value. In the TSP aims to minimize the distance, then the fitness value is the inversion of the distance.
8. Operator mutations to modify chromosomes.
9. Genetic Algorithm is one of the algorithms that can be used in scheduling optimization, the advantages possessed by the genetic algorithm are that it can optimize complex problems and a very wide search space[7].

Reference[8], Nurse shift schedules that often occur simultaneously. The result of research are, the entry schedule displayed by the system can be a reference for the hospital in scheduling nurses to occupy space according to the admission schedule. Reference[9], The first problem is when there is a schedule with the same space at one time causing a crash on the space user. The second problem is when there is the same class at a different time and place. The application of the genetic algorithm in this study uses 6 chromosomes so as to produce optimal solutions. The crossover rate is set at 80%, and the mutation rate is controlled at 0.3 or 30%. Based on application trials, it shows that the results of scheduling with genetic algorithms are able to eliminate schedule clashes.

Reference[10], Hospitals do not yet have a system that can manage doctors and nurses' schedules. Each time the test is carried out, it produces a different solution because in the Genetic Algorithm the initial population is randomly generated, but it can provide the optimal solution. The

genetic algorithm can generate scheduling optimization according to the specified rules.

Reference[9], [11] In the aspect of teaching activities it is very important for the smooth running of the teaching and learning process in schools, and sometimes time is often saved for the developers. The genetic algorithm is quite effective and efficient for making teaching schedules compared to the manual method. r Genetic algorithms are quite effective and efficient for making teaching schedules compared manually.

Reference[12], Tour guide scheduling that occurs at this time results in an uneven schedule composition in placement and service, to provide the appropriate number of tour guides without reducing the quality of service, which involves dealing with requested quantity range. Producing an optimizing system for scheduling natural window tour guides using a genetic algorithm. The end result of this system is the formation of a tour guide schedule in a month. This system uses the attribute of the number of tour guides as many as 188 people in 30 working days and a maximum of 50 tour guides will be placed in the main place category, so there are 1500 genes.

III. RESEARCH METHODS

Documents, diagrams, or software that function as artifacts created in one stage will become input for the next stage. Finally, the software is delivered to the customer. The sequence of steps used by this method is usually referred to as the Software Development Life Cycle (SDLC). SDLC is defined, well-structured work stages carried out by systems analysts and programmers in building a quality software. SDLC done properly can enable the highest level of management control and documentation. Developers understand what they have to build and why. All parties agree on goals up front and see a clear plan for achieving those goals. Everyone understands the costs and resources required[4].

waterfall is a method developed for software development, making software. The model progresses systematically from one stage to another in a waterfall-like fashion. This waterfall model proposes an approach to systematic and sequential software development starting from the level of system progress in all analysis, design, code, testing, and maintenance.[5].

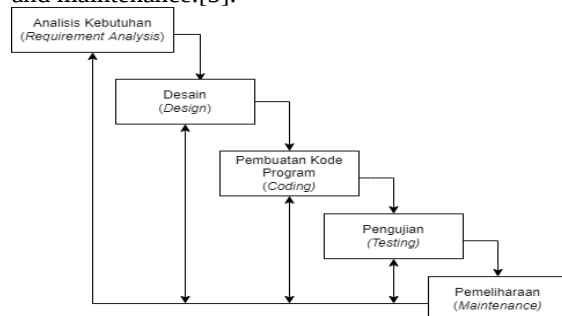


Figure 1. SDLC (System Development Life Cycle) Waterfall

1. Needs Analysis

Requirements are one of the important points in system design, in this case the researcher analyzes requirements based on user requirements and system requirements.

2. Design

The design process is a stage to describe the state of the system that will be designed using system tools including Entity Relationship Diagram (ERD), Logical Record Structure (LRS) and Unified Modeling Language (UML) so that it makes it easier for programmers to carry out the coding process.

3. Coding

After the system design stage, the researcher carried out a code generation process where the system tools created were translated into a programming language, in this case the researcher used the php html programming language.

4. Testing

Testing is a step to test the system that has been designed at the code generation stage. This process is done to minimize system errors (system errors). The technique used is the blackbox system.

Usability testing provides this access to the user using the product to perform the tasks to be performed, which match the user's realistic goals. In a test situation, have a chance to get user comments, to observe user body language (in most cases), to find out what users want and expect from products, and to learn how well the product supports the user in the user's goal.[13]

5. Maintenance

The support process is carried out to strengthen the results of the system design with the aim of checking the completeness of the system implementation such as hardware and software in the institution so that the system can be implemented and used to the fullest extent possible. As well as the maintenance process carried out on the system for the survival of the system in the future.

IV. RESULTS

Data collection through observation and interviews was carried out with one of the employees of RSUD Dr. RM. Djoelham. From the observations and interviews, the results were obtained in the form of an ongoing scheduling business process flow. The following is an explanation of how the procedure runs at Dr. RM. Djoelham regarding scheduling, including:

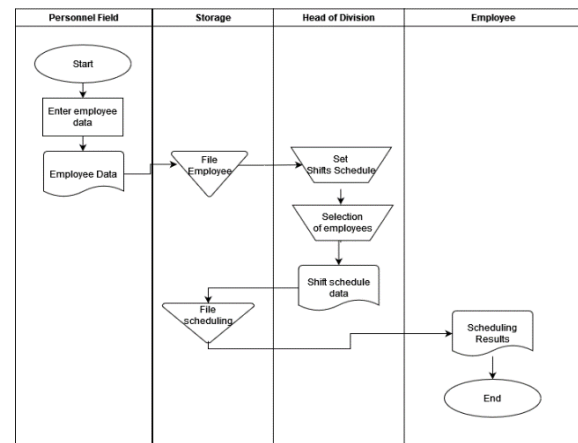


Figure 2. Business Process Flowcharts

From the observations and interviews conducted, the results were obtained in the form of the ongoing employee scheduling process flow and also what obstacles were faced by employees. The process carried out in employee scheduling begins with the staffing field to collect employee data manually by writing down medical and non-medical data on Microsoft Excel. After that the data is stored on computer data. Every month the Head of Staff will arrange employee shift schedules and select schedules. After selecting the file schedule, employees will be distributed in paper form.

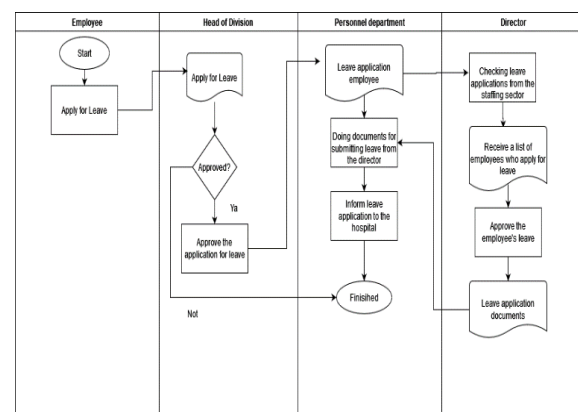


Figure 3. Leave Application Business Process

The flow of the employee leave application process carried out at RSUD Dr. RM. Djoelham, with the employee's process of applying for leave to the chief employee, after the chief employee accepts the leave application agrees to the leave application, the personnel department accepts the employee leave request, the Director checks the leave application from the staffing department, receives a list of employees who submitted leave requests and approves the leave that has been submitted by employees. Documents for applying for leave from the director will be given back to the personnel department, the head of staff receives the document for applying for leave from the Director, informs the employee's leave application letter to the hospital.

In determining the schedule there are problems and the factors that cause these problems can occur including the following:

1. Setting the shift schedule is still using the manual method and there is no prevention system for shift errors.
2. Still using paper, this is prone to damage such as lost files, or damage due to wet or torn data, searching for data will also take time because you have to check one file at a time.

Based on the results of observations and interviews conducted, the process flow of activities at RSUD Dr. RM. Djoelham has deficiencies in terms of scheduling so that service management is not optimal. Looking for the causes of the problems faced by RSUD Dr. RM. Djoelham can be identified with a fishbone diagram by tracing the scheduling process carried out by RSUD Dr. RM. Djoelham and compare with other hospital business processes. Several elements of the RSUD Dr. scheduling process. RM. Djoelham has obstacles including:

1. Data Storage

The data storage aspect is caused by the amount of lost data, data errors, data not integrated, and long searches. Because data storage does not use a database that is not integrated, and systematic.

2. Man

On the human aspect caused by limited human resources, late employees, and human error. Because shift scheduling arrangements that are not structured properly make human resources inefficient. The sudden preparation of the schedule also makes the workforce miss information on working hours which causes the workforce to be late or have an empty shift.

3. Data Entry

In the aspect of inputting data, it is problematic because the data is recorded manually, there is too much data, and the data is not neatly arranged. Due to the absence of a system that helps the process of entering data automatically to simplify, organize data, and all input is regulated by the system so as to minimize errors.

4. Performance

In the performance aspect there are problems caused by conflicting shift scheduling, complicated scheduling, and long report generation. In preparing a schedule that requires accuracy so that there are no mistakes that make the scheduling of shifts clash.

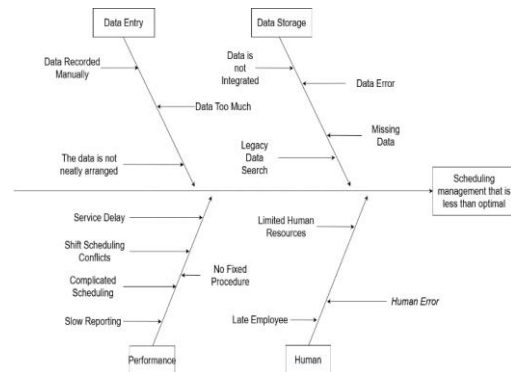


Figure 4. Fishbone diagrams

The following is the use case diagram design used to build a scheduling management information system at RSUD Dr. RM. Djoelham.

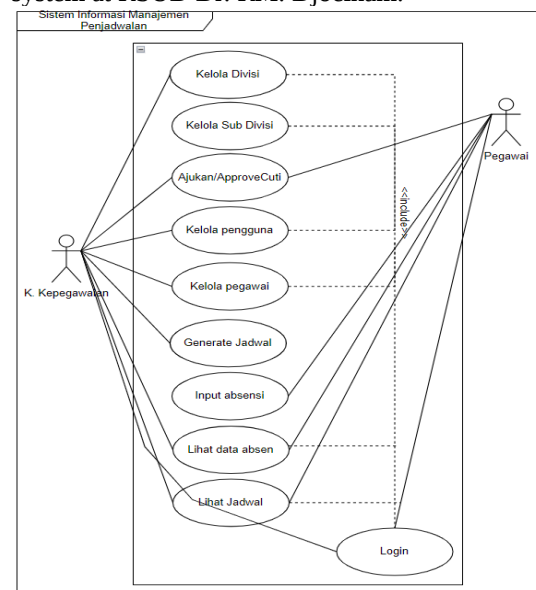


Figure 5. Use case Diagrams

this is a use case diagram consisting of two actors, namely the Head of Staffing and Employees. Where the Head of Personnel can access work schedules, manage employees, manage work schedules, manage users, manage work plans and work reports. Meanwhile, employees can access work schedules. All of these actors must log in before they can access the system.

The ERD design was carried out to explain the design of a database related to the designed management information system.

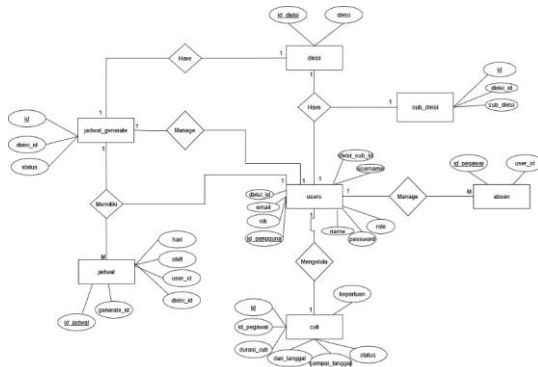


Figure 6.ERD

Based on the ERD design in this study. The explanation of the ERD design is as follows:

1. The users entity has a primary key which is id_users. In addition, the users entity has attributes, namely namee, email, nik, divisi_id, divisi_sub, username, role, contents_cuti
2. The leave entity has a primary key, namely id_cuti. In addition, the leave entity has attributes employee_id, leave_duration, from_date, to_date, needs and status.
3. The absent entity has a primary key, namely id_absen and has a user_id attribute
4. The schedule_generate entity has a primary key that is id_generate and has an attribute divisi_id, status.
5. The schedule entity has a primary key, namely id_schedule. In addition, the schedule entity has day, shift and generate_id, user_id, division_id attributes
6. The division entity has a primary key, namely id_divisi, has an attribute, namely nama_divisi.
7. The division_sub entity has a primary key namely id_divisi_sub, has attributes namely sub_divisi and id_divisi.

This section displays the results of the implementation of the interface design that has been made. The following is the result of the interface design that has been implemented on the website.

1. Division Menu Display

Below is a display of the division menu, this page displays each division in the Hospital. The following is the interface display of the division menu.

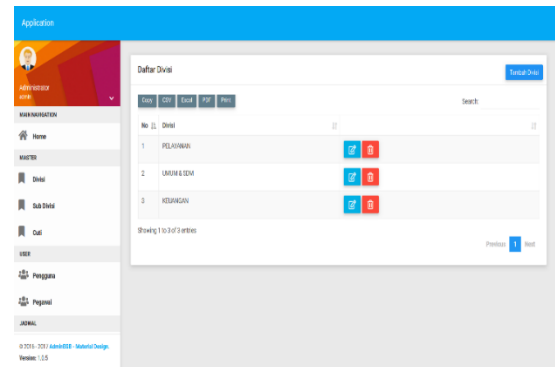


Figure 7.Division Menu Display

2. Display Leave Menu

Below is a display of the leave menu, this page displays the leave menu submitted by employees from the hospital. The following is a display of the menu.

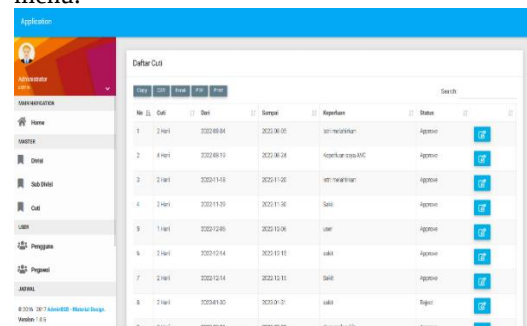


Figure 8.Display Leave Menu

3. Display Schedule Generate Menu

Below is a display of the schedule generate menu, on this page displays the employee schedule generation menu from the Hospital. The following is a display of the schedule generate menu, first select the division to be generated, after success the system displays a successful message.

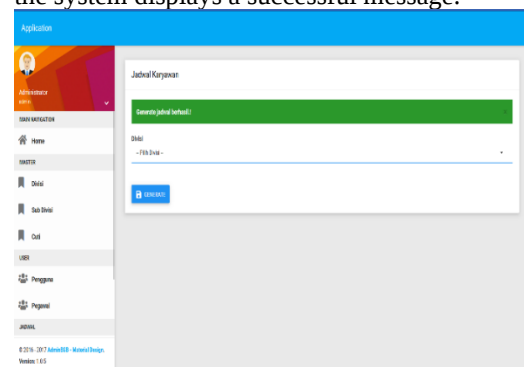


Figure 9.Display Schedule Generate

The following is the source code of the schedule generation process using a genetic algorithm. Where in the program code for carrying out genetic calculations there is a genetic function, then each parameter is explained according to the total working days of each employee. And for the shifts used, namely morning, afternoon, and evening, then the shift is

divided, namely 3 people per shift. Next, it will display the names of employees whose shifts have been divided.

```

// PHP
defined('BASEPATH') or exit('No direct script access allowed');

class Jadwal extends CI_Controller {
    public function __construct() {
        parent::__construct();
        if($this->session->userdata('loginData')){ redirect('login'); }
        $this->load->model('M_user');
        $this->load->model('M_divisi');
    }

    public function genetika() {
        $shift = count([1,2,3,4,5]); // Total hari kerja, di sini contoh 1-5 (Senin - Jumat)
        $shift = ['Pagi', 'Sore', 'Malam']; // Shift nya kapan aja
        $orang_pershift = 3;
        $listkaryawan = $this->M_user->getListPegawai();

        // Check jumlah karyawan minimal antara hari dan shift
        $total_y = count($shift) * $orang_pershift;
        if (count($listkaryawan) < $total_y) {
            die('Jumlah karyawan kurang dari total shift dan jumlah orang yang diperlukan pershift');
        }

        // ----- Inisialisasi data
        // Random data individu pertama
        $matrix_individu_pertama = [];
        for ($i=0; $i < $shift; $i++) {
            for ($j=0; $j < $total_y; $j++) {
                $matrix_individu_pertama[$i][$j] = mt_rand(1, count($listkaryawan));
            }
        }
    }
}

```

Figure 10 Genetic Algorithm Source Code

explains the schedule that you want to generate, for example how many working days and what shifts will be generated in a week, it can be morning, afternoon and evening. Then perform calculations by calculating the first fitness matrix by evaluating the fitness for the first individual, then performing the calculation of the second fitness matrix by evaluating the first individual. Then perform the first probability by adding up the total from the first fitness matrix plus the total from the second fitness matrix. Next, calculate the crossover using the first fitness matrix and the second fitness matrix. then do the mutation using crossover, day, and total.

4. Schedule Menu Display

Below is a display of the schedule menu, this page displays the schedule menu from employees at the Hospital. The admin first chooses the division for which the schedule will be seen, after that the generate on option is the choice of date when the generate process is carried out. The following is a display of the Schedule menu that has not been generated.

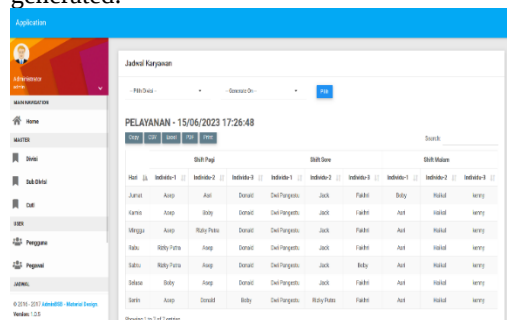


Figure 11. Schedule Menu Display

5. Absent Data Menu Display

Below is a display of the absent data menu, this page displays the employee absence data menu from the Hospital. The following is a display of the absent data menu.

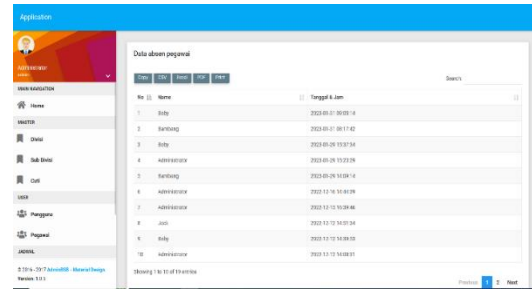


Figure 12. Absent Data Menu Display

6. Employee Data Menu Display

Below is a display of the employee data menu, this page displays a list of employees from the Hospital in each division. On this page the admin can add employee data, change data and delete employee data. The following is a display of the employee data menu.

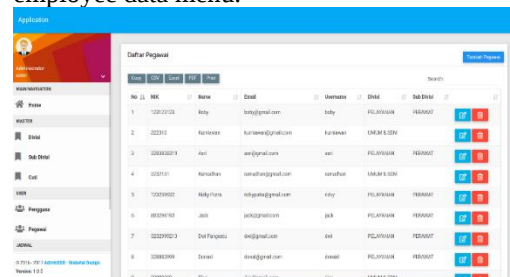


Figure 13. Employee Data Menu Display

In this study, system testing uses the black box testing method where testing only focuses on the functional specifications of the software, the tester can define input conditions and perform tests on the program's functional specifications. The results of the black box testing that has been carried out are as follows:

Table 2. Black Box Test (Admin)

No	Test Items	Testing Scenarios	Expected results	Information
1	Login page	Enter username and password	Enter and display the dashboard page according to the role	Success
		Enter the wrong username and password	Unable to enter the system	Success
2	Manage Users page	Can display user data	Displays user data	Success
		Add User data	Saved user data	Success
		Edit user data	User data changed	Success
		Delete user data	User data deleted	Success
3	Manage Employees page	Can display employee data	Displays employee data	Success
		Add employee data	Stored employee data	Success
		Edit employee data	Employee data changes	Success
		Deleting employee data	Employee data deleted	Success
4	Schedule generator page	Can display data generate schedule	Displays schedule data	Success
5	View Schedule page	Displays employee schedule data	Displays work schedule data that has been processed	Success

			using a genetic algorithm	
6	Absence Form	Displays the attendance form	Displays the attendance form	Success
7	Manage Division/Subdivision Page	Can display division/sub-division data	Displays division/sub-division data	Success
		Adding divisions/subdivisions	Division/subdivision data is stored	Success
		Editing divisions/subdivisions	Division/subdivision data changes	Success
		Delete divisions/subdivisions	Data division/subdivision deleted	Success

Table 3. Black Box Test (Employee)

Test Items	Testing Scenarios	Expected results	Information
Login page	Enter username and password	Enter and display the dashboard page according to the role	Success
	Enter the wrong username and password	Unable to enter the system	Success
Schedule Page	Can display employee schedule	Displays employee schedules	Success
	Can print employee schedule	Print employee schedules	Success
Attendance Input page	Can input attendance	Missing successfully	Success
Page View Attendance Data	Can view attendance data	Displays attendance data	Success
	Can print attendance data	Print attendance data	Success
Leave Request page	Can add leave	Add data for leave requirements	Success
	Can change leave data	Displays change leave data	Success
	Can see the status of the leave application	Displays Leave Application Status	Success

Table 4. Usability Testing

Scenario 1 : Generate Schedule			
Participant: Sarilena Tarigan, SKM			
Categories	Findings	Comments	Likes/Dislikes
Interactivity	There is a hover when the cursor is directed to the schedule generate button which indicates that the cursor is right on that button		Like : when pressing the select division button, there is a difference between the hover symbol between the title and the division selection.
Aesthetics	The overall schedule generate menu display is simple, there are special symbols and buttons that		Dislike: when displaying schedule results there is no need for scrolling.

	indicate the differences for generating schedules.		
LAYOUTS	The layout of the generated schedule is appropriate, so it's easy to find it.	Some more features can be added under the generate schedule section	Dislike: there is still a lot of empty space below after generating the schedule

Scenario 2 : Employee Schedule			
Participant: Sarilena Tarigan, SKM			
Categories	Findings	Comments	Likes/Dislikes
Interactivity	There is a hover when the cursor is directed to the division select button, Generate On and which indicates that the cursor is right on that button, when pressing the division select button.		Like: when pressing the select division button, there is a difference between the hover symbol between the title and the division selection.
Aesthetics	For the use of color and font type is good enough.		Dislike: when displaying schedule results there is no need for scrolling.
LAYOUTS	The layout of the search field is correct, at the top right of the page.		Like: The position of the search field is appropriate so that it can be found immediately.

Scenario 3 : Leave Data			
Participant: Sarilena Tarigan, SKM			
Categories	Findings	Comments	Likes/Dislikes
Interactivity	when the cursor is placed on the table title there will be a hover which if clicked then the contents of the table will be sorted ascending or descending		
Aesthetics	There is a color difference between the even and odd rows in the table contents		
LAYOUTS	The layout of the edit field is correct, to the right of the leave data		Like: The position of the edit field is appropriate so that it can be found immediately.

V. CONCLUSION

Based on the results of research conducted on Management Information Systems at RSUD DR. RM. Djoelham regarding scheduling can be summed up as follows, scheduling information system at RSUD DR. RM Djoelham, which is designed based

on a website using the PHP programming language, CodeIgniter as a framework, and MySQL as a database to help the schedule creation process is no longer done manually and can be done automatically making it easier for the admin to arrange schedules so there are no conflicts. This built system implements a genetic algorithm to assist in generating schedules to minimize errors. The scheduling information system has a history of being able to display information or reports related to the schedule of each division and the date when the schedule was made.

There are suggestions from research conducted on Management Information Systems at RSUD DR. RM. Djoelham regarding scheduling. This system can be developed better by adding a schedule email notification feature from each employee on duty. This system can be developed by adding an absence feature that is directly connected to scheduling. This system can be developed by adding the leave balance to the employee leave application feature.

REFERENCES

- [1] I. H. G. Manurung, "Sistem Informasi Lembaga Kursus Dan Pelatihan (LKP) City Com Berbasis Web Menggunakan PHP Dan Mysql," *Jurnal Mahajana Informasi*, vol. 4, no. 1, 2019.
- [2] A. Sabela Hasibuan, M. W. Siburian, D. APIKES Imelda, J. Bilal Nomor, and A. APIKES Imelda, "Sikap Petugas Terhadap Pengisian Rekam Medis Rawat Inap Di Rumah Sakit Sinar Husni Tahun 2017," 2017. [Online]. Available: <http://sinarhusnihospital.co.id>
- [3] S. F. Pane, R. Maulana Awangga, E. V. Rahmadani, and S. Permana, "Implementasi Algoritma Genetika Untuk Optimalisasi Pelayanan Kependudukan," *Jurnal Tekno Insentif*, vol. 13, no. 2, pp. 36–43, Oct. 2019, doi: 10.36787/jti.v13i2.130.
- [4] R. Rizki Damanik, "Aplikasi Penjadwalan Perawat Rs Porsea Menggunakan Algoritma Genetika," vol. 5, no. 1, 2020.
- [5] Y. Anggraini, D. Pasha, and A. Setiawan, "Sistem Informasi Penjualan Sepeda Berbasis Web Menggunakan Framework Codeigniter (Studi Kasus : Orbit Station)," *Jurnal Teknologi dan Sistem Informasi (JTSI)*, vol. 1, no. 2, pp. 64–70, 2020, [Online]. Available: <http://jim.teknokrat.ac.id/index.php/JTSI>
- [6] E. Susanto *et al.*, "Jurnal Sustainable: Jurnal Hasil Penelitian dan Industri Terapan," vol. 10, no. 01, p. 2021, 2021.
- [7] M. Rifqy Zakaria and P. Sari, "Penerapan Total Quality Management Pada Perencanaan Kaizen Kualitas Plating Di Pt Surteckariya Indonesia Dengan Metode Fishbone Berbasis Android," *Jurnal Informatika SIMANTIK*, vol. 4, no. 2, 2019, [Online]. Available: www.jurnal.stmikcikarang.ac.id
- [8] T. Snadhika Jaya, P. Studi Manajemen Informatika, J. Ekonomi dan Bisnis, and P. Negeri Lampung JlnSoekarno, "Pengujian Aplikasi dengan Metode Blackbox Testing Boundary Value Analysis (Studi Kasus: Kantor Digital Politeknik Negeri Lampung)," *Jurnal Informatika: Jurnal Pengembangan IT (JPIT)*, vol. 03, no. 02, 2018.
- [9] T. Mesin, U. Malang, and B. Singosari, "Implementasi Algoritma Genetika Dalam Eliminasi Bentrokan Jadwal Perkuliahan Di Politeknik Unisma Malang Nur Shofiyati 1, Muh. Ulinnuha Musthofa 2, Aditya Mahendra Putra 3," vol. 6, no. 1, 2021.
- [10] Y. V. Via *et al.*, "Optimasi Penjadwalan Pegawai Rumah Sakit Menggunakan Algoritma Genetika," 2017.
- [11] G. Ayu, D. Saryanti, and I. K. Wijanegara, "Penerapan Metode Algoritma Genetika Untuk Penjadwalan Mengajar," *Jurnal SIMETRIS*, vol. 8, 2017.
- [12] Y. Yudriani, E. C. Djamal, R. Ilyas, and U. Jenderal Achmad Yani Jl Terusan Jenderal Sudirman, *Optimalisasi Penjadwalan Jaga Dokter dan Tenaga Medik di Rumah Sakit Dustira Menggunakan Algoritma Genetika*. 2017.
- [13] C. Barnum M, "Praise for Usability Testing Essentials," 2011.