The Best Nurse Selection Decision Support System At Dr. Hospital. Hadrianus Sinaga Using the Analytical Hierarchy Process (AHP) Method

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Abstract. In this study, the authors conducted a study to apply the Analytic Hierarchy Process (AHP) method in the Selection of the Best Nurses and build applications in the application of the method. A nurse is a person who cares for and cares for other people who have health problems. But in its development, the understanding of nurses is getting wider. At this time, the notion of nurses refers to their position as part of health workers who provide services to the community in a professional manner. Decision Support System (DSS) is part of an interactive computer-based information system that is useful for supporting decision-making. The results of this study are the results of the final calculation or ranking, the best nurse chosen is A01 - Lenny M. Simbolon with a value of 0.342. so that the researcher concludes to apply the analytic hierarchy process (AHP) method in the decision support system for selecting the best nurse at RSUD Dr. Hadrianus Sinaga must follow the AHP work steps by comparing the values of each criterion to produce a criteria comparison matrix, Criteria Priority Weight Matrix, Criteria Consistency Matrix and then determine the location comparison scale value based on each criterion. After finding the weight of each criterion against the predetermined alternative, the next step is to multiply the weight of each criterion by the weight of each alternative, then the results of the multiplication are added up by the line. So that the total global priority is obtained. To build a decision support system for selecting the best nurse using the Analytical Hierarchy Process (AHP) method, the authors first analyze system requirements, perform calculations using the AHP method, design systems with UML

Keywords— DSS, AHP, Selection of the Best Nurse

1. Introduction

Information technology that is growing at this time is very supportive of the needs of an agency. Both to realize the effectiveness and efficiency of work as well as in improving services to the community. The performance of employees in an agency, especially government agencies, is required to be faster in completing work because it is related to public services so that it can satisfy the public. Information technology can also assist management or structural officials in making decisions so that decisions issued by agencies are more relevant and acceptable to all parties.

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In every agency, employees are a very important resource to determine the success of a work unit. The quality of human resources is one of the factors needed to increase the productivity of an agency. Qualified employees will facilitate the work unit in achieving its goals, both in terms of dedication and service. One of the techniques used by the management of an organization/work unit in improving the quality of human resources is to conduct a performance appraisal. With the performance appraisal, the employee who has the best performance will receive an award in the form of material or position. as well as encouragement to further improve work performance and dedication.

Nurses in the Dr. Hadrianus Sinaga are required to provide fast service. In the service process what must be known is ethics. Ethics is behavior that is worthy of being accepted by someone, polite and respectful. Regarding the problem of nursing services at RSUD Dr. Hadrianus Sinaga should run systematically, directed, and monitored according to the rules that have been set and enforced, but the reality has not been fully achieved. There are complaints or complaints from the public regarding the performance of employee services, such as slow, non-transparent, less informative, less consistent performance, or employees not being in the office when the community needs them (Lisi I.Z., et al, 2015).

In improving the quality of public service in RSUD Dr. Hadrianus Sinaga, in this case, the nurse, the leadership has made various innovations. One of them is giving awards to nurses who have achievements. However, the performance assessment that has been carried out so far does not meet the standard criteria of an organization's work, because performing performance calculations is still limited to a recapitulation of attendance by way of manual attendance recapitulation which takes a long time. This, of course, in addition to taking a long time, also allows for calculation errors. Nurse performance appraisal related to the successful implementation of duties and personnel capabilities does not affect the improvement of service quality to the community.

The problems faced in performance appraisal at RSUD Dr. Hadrianus Sinaga, namely, (1) the performance assessment that has been carried out so far does not meet the criteria/indicators of an organization's work standards, because performing performance calculations is still limited to a recapitulation of attendance by manually recapitulating attendance/attendance which takes a long time. (2) The current assessment system cannot be processed into performance appraisal data that is useful for validating performance appraisals and maintaining the accuracy of the data used. (3) Assessment of the performance of nurses at RSUD Dr. Hadrianus Sinaga regarding the successful implementation of duties and personnel capabilities does not have any implications for the amount of performance allowance received by the outstanding nurse. (4) A decision support system for selecting the best nurse is needed to select employees to increase the quality of service.

Kristiana T. (2015) conducted a study entitled "Application of Profile Matching for Performance Assessment of Civil Servants (PNS)". Karya produces one winner for each servant award, both main, Pratama and junior servant awards.

Other research on the selection of the best civil servants to improve employee performance was also conducted by Karsa S.E&Devitra J. (2017), the research was conducted using the Fuzzy Logic method, where the results obtained were applications that used fuzzy logic for selecting civil servants to become exemplary civil servants. can be more qualified and effective.

2. Research Method

2.1. Problem Identification

This stage is the stage where the author identifies the problem that occurs. Identifying the problem begins by examining the subject of the existing problem. The identification of problems that exist in the study are:

1. The performance assessment that has been carried out so far does not meet the criteria/indicators of an organization's work standards, because performing performance calculations is still limited to a recapitulation of attendance by manually recapitulating attendance/attendance which takes a long time.

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2. The current assessment system cannot be processed into performance appraisal data that is useful for validating performance appraisals and maintaining the accuracy of the data used.
3) Assessment of the performance of nurses at RSUD Dr. Hadrianus Sinaga regarding the successful implementation of duties and personnel capabilities does not have any implications for the amount of performance allowance received by the outstanding nurse.
4) A decision support system for selecting the best nurse is needed to select employees to increase the quality of service.

2.2. Analyzing the Problem
In this stage, the author analyzes the problems that occur. This study, which refers to the problems that arise is how to overcome them in determining the best nurse at RSUD Dr. Hadrianus Sinaga using the Analytical Hierarchy Process Method.

2.3. Data Collection
This stage is a stage carried out by researchers to obtain information to achieve research objectives. In this study, the authors used two data, namely primary data and secondary data. Primary data is data obtained from interviews by informants, while secondary data is data obtained from books, journals, and the internet. The data collected is as follows:
1. Observation
At this stage, the author conducts a direct review of the location to conduct research
2. Interview
This stage is to conduct interviews with the RSUD DR. Hadrian Sinaga. By conducting a question, and answer session about the assessment of nurses in RSUD DR. Hadrian Sinaga.
3. Literature Study
This stage is the stage of collecting data from books, journals, and internet sources. The goal is to study theories related to research. Internet facilities are also used by the media to search for data or information published in cyberspace related to the object of research.

2.4. Analyzing Data with Analytical Hierarchy Process Method
This stage is a process where researchers process data using the Analytical Hierarchy Process Method to overcome all problems that arise in the formulation of the problem and are expected to make it easier to determine nurses who receive poor assistance at Dr. Hospital. Hadrian Sinaga. The way the Analytical Hierarchy Process method works are to give weight to each specified criterion. From the weight assessment, the highest rank will be taken to determine the best nurse.

2.5. System Design
At this stage is the stage where researchers will design a system using UML (Unified Modeling Language) modeling to describe the flow of completion. The UML used are: Use Case Diagrams, Activity Diagrams, Class diagrams.

2.6. System Design
At this stage is the stage where the researcher will build a system to help the RSUD Dr. Hadrianus Sinaga in making decisions, and applying the Analytical Hierarchy Process method to the system. In the development of the application, the author will create a web-based application.

2.7. Report Preparation
At this stage is the preparation of research reports obtained from all stages that have been carried out and documentation of the results of the analysis and implementation of the Analytical Hierarchy Process Method. System Testing.

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3. Result and Discussion

The results of this study will be explained in the following stages:

3.1. Determining the Priority of the Main Criteria

1. Create a pairwise comparison matrix

Table 1. Best nurse selection criteria

Criteria	Keterangan
C_{01}	Kedisiplinan
C_{02}	Sikap
C_{03}	Penampilan
C_{04}	Kerja Sama
C_{05}	Kehadiran

The table above is the criteria for choosing the best nurse

Table 2. Alternative

NO	Name
1	Lenny M. Simbolon
2	YustikaManalu
3	SumiharTamba
4	Pesta Helen Sinaga
5	Rediana Turnip

The table above is an example of a list of nurses who will be tested

Table 3. Criteria paired matrix

Criteria	C_{01}	C_{02}	C_{03}	C_{04}	C_{05}
C_{01}	1	3	5	7	5
C_{02}	0.333	1	3	5	7
C_{03}	0.2	0.333	1	3	5
C_{04}	0.143	0.2	0.333	1	2
C_{05}	0.2	0.143	0.2	0.5	1

2. Simplified criteria matrix

Table 4. Simplified criteria matrix

Criteria	C_{01}	C_{02}	C_{03}	C_{04}	C_{05}
C_{01}	1	3	5	7	5
C_{02}	0.333	1	3	5	7
C_{03}	0.2	0.333	1	3	5

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C_{04}	0.143	0.2	0.333	1	2
C_{05}	0.2	0.143	0.2	0.5	1
∑	1.876	4.676	9.533	16.5	20

3. Performing the Calculation of the Criteria Priority Weight Matrix

Table 5. Criteria Priority Weight Matrix

Criteria	C_{01}	C_{02}	C_{03}	C_{04}	C_{05}	Vector Eigen
C_{01}	0.533	0.642	0.525	0.424	0.25	0.475
C_{02}	0.178	0.214	0.315	0.303	0.35	0.272
C_{03}	0.107	0.071	0.105	0.182	0.25	0.143
C_{04}	0.076	0.043	0.035	0.061	0.1	0.063
C_{05}	0.107	0.031	0.021	0.030	0.05	0.048

4. Calculating Criteria Consistency Matrix

Table 6. Criteria Consistency Value Matrix

Criteria	C_{01}	C_{02}	C_{03}	C_{04}	C_{05}	Consistency
C_{01}	0.533	0.642	0.525	0.424	0.25	5.654
C_{02}	0.178	0.214	0.315	0.303	0.35	5.544
C_{03}	0.107	0.071	0.105	0.182	0.25	5.287
C_{04}	0.076	0.043	0.035	0.061	0.1	5.216
C_{05}	0.107	0.031	0.021	0.031	0.05	5.064

5. Calculating Consistency Ratio

Table 7. Index Ratio Based on Order of Matrix

Ordomatriks	1	2	3	4	5	6	7	8	9	10
Ratio index	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.46	1.49

To obtain index consistency, the formula used is as follows:

max = total/n
CI = (λ max – n)/(n-1)
CR = CI/RI
Information :
total: The result of the sum in the total column
N:Number of criteria, in this case 5
CI: Consistency Index
RI: Ratio Index
max = (5,654 + 5,544 + 5,287 + 5,216 + 5,064) / 5
= 5.353
CI = (5,353– 5) / 5 – 1
= 0.08825
CR = CI / RI
= 0.08825/1.12
= 0.07879

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3.2. Determining the Alternative Comparison Matrix

Furthermore, after finding the priority weights of the criteria, determine the value of the alternative comparison scale based on each criterion. After forming a comparison matrix based on the criteria, the priority weights are sought for the comparison of alternatives to each criterion. Create the next criteria in the same way.

1. Alternative Comparison Matrix Based on Discipline Criteria

Table 8. Matrix Based on Discipline Criteria

Alternatives	A_{01}	A_{02}	A_{03}	A_{04}	A_{05}
A_{01}	1	2	3	4	5
A_{02}	0.5	1	2	3	4
A_{03}	0.333	0.5	1	2	3
A_{04}	0.25	0.333	0.5	1	2
A_{05}	0.2	0.25	0.333	0.5	1
$\sum$	2.283	4.083	6.833	10.5	15

2. Alternative Priority Weight Matrix Based on Discipline Criteria

Table 9. Weight of Criteria Based on Discipline Criteria

Alternatives	A_{01}	A_{02}	A_{03}	A_{04}	A_{05}	Bobot
A_{01}	0.438	0.49	0.439	0.381	0.333	0.416
A_{02}	0.219	0.245	0.293	0.286	0.267	0.262
A_{03}	0.146	0.122	0.146	0.19	0.2	0.161
A_{04}	0.109	0.082	0.073	0.095	0.133	0.099
A_{05}	0.088	0.061	0.049	0.048	0.067	0.062

3. Perform calculations for each Alternative Comparison Matrix and Alternative Priority Weight Matrix Based on Attitude, Appearance, Cooperation, and Attendance Criteria.

3.3. Determining Criteria and Alternative Eigenvalues

After finding the weight of each criterion against a predetermined alternative, the next step is to multiply the priority weight (Eigenvector) of each criterion with the weight of each alternative, then the results of the multiplication are added up by the line. So that the total global priority is obtained as shown in the following table.

Table 10. Calculation result

Alternatif	C_{01}	C_{02}	C_{03}	C_{04}	C_{05}	Nilai
Vektor Eigen	0.475	0.272	0.143	0.063	0.048	
A_{01} – Lenny M. S	0.416	0.288	0.231	0.26	0.348	0.342
A_{02} – YustikaManalu	0.262	0.204	0.205	0.245	0.291	0.238
A_{03} – SumiharTamba	0.161	0.126	0.176	0.121	0.201	0.153
A_{04} – Pesta Helen S	0.099	0.191	0.194	0.188	0.09	0.142
A_{05} – Rediana Turnip	0.062	0.191	0.194	0.188	0.071	0.124

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3.4. Alternative Ranking

Based on the eigenvalues of the criteria and alternatives above, it can be shown that the ranking of the best nurses is as shown in the following table:

Table 11. Alternate ranking

Alternatives	Nilai	Ranking
A_{01} – Lenny M. Simbolon	0.342	1
A_{02} – YustikaManalu	0.238	2
A_{03} – SumiharTamba	0.153	3
A_{04} – Pesta Helen Sinaga	0.142	4
A_{05} – Rediana Turnip	0.124	5

In the final calculation or ranking, the best nurse chosen is A01 – Lenny M. Simbolon with a value of 0.342.

3.5. System Implementation Results

This decision support system application is equipped with a display that aims to make it easier for users. The function of this interface is to provide input and display output from the application. This application has an interface consisting of a login page, main page, alternative page, aspect page, criteria page, profile page, calculation page, change password page, and a logout button.

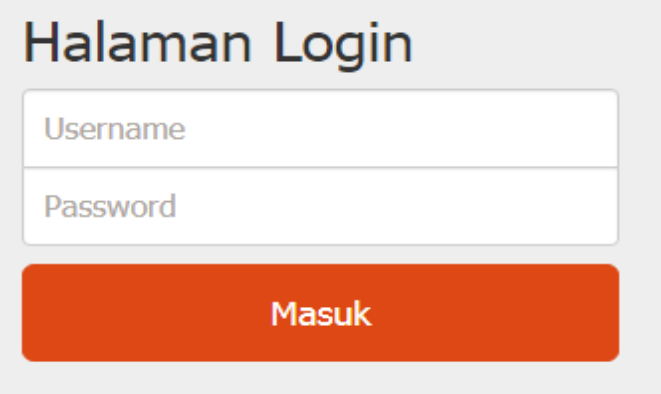

Figure 1. Login

Next is the display to see the calculation results from the AHP method :

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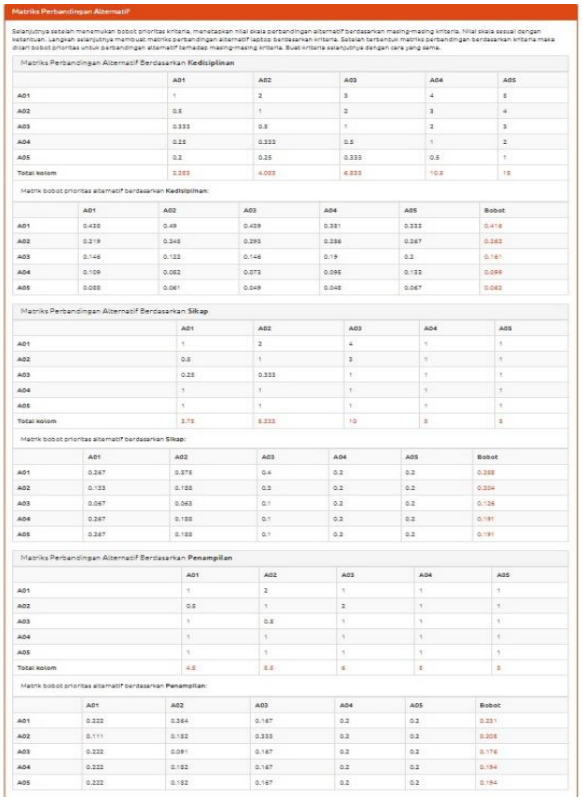

Figure 2. Alternative Comparison Matrix AHP Calculation Page

Next is the AHP Calculation Page of the Final Results obtained:

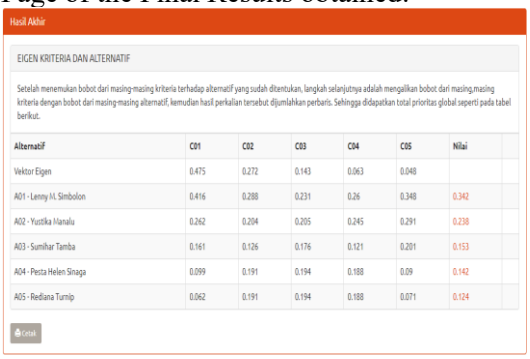

Figure 3. Final Results Page

Next is the page to print a ranking of the nurse scores so that the best nurse scores are obtained:

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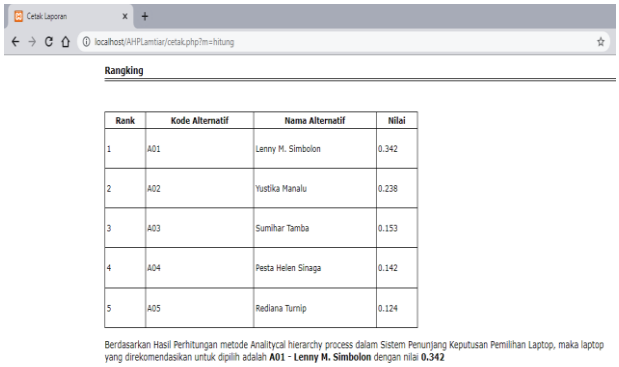

Figure 3. Rangking Results Page

4. Conclusion

1. To apply the analytic hierarchy process (AHP) method in the decision support system for selecting the best nurse at RSU. Dr. Hadrianus Sinaga must follow the AHP work steps by comparing the values of each criterion to produce a criteria comparison matrix, Criteria Priority Weight Matrix, Criteria Consistency Matrix, and then determine the location comparison scale value based on each criterion. After finding the weight of each criterion against the predetermined alternative, the next step is to multiply the weight of each criterion by the weight of each alternative, then the results of the multiplication are added up by the line. So that the total global priority is obtained.
2. To build a decision support system for selecting the best nurse using the Analytical Hierarchy Process (AHP) method, the author first analyzes system requirements, performs calculations using the AHP method, system design with UML which includes the design of use case diagrams, activity diagrams, sequence diagrams, and class diagrams, database design, user interface design, and web-based system development.

5. References

[1] A. S., Rosa dan Shalahuddin, M. 2013. Rekayasa Perangkat Lunak Terstruktur Dan Berorientasi Objek. Bandung: Informatika.

[2] Dicky Nofriansyah dan Sarjon Defit, 2017, Multi Criteria Decision Making (MCDM) Pada Sistem Pendukung Keputusan, Yogyakarta : Depublish.

[3] E. Yulianti and R. Damayanti, "Sistem Pendukung Keputusan Untuk Menentukan Penerimaan Beasiswa Bagi Siswa SMAN 9 Padang Dengan Menggunakan Metode AHP (Analytical Hierarchy Process)," J. TEKNOIF, vol. 3, no. 2, pp. 21–28, 2015

[4] Frieyadie, F. (2017). Penerapan Metode Ahp Sebagai Pendukung Keputusan Penetapan Beasiswa. Jurnal Pilar Nusa Mandiri, 13(1), 49-58.

[5] Hamim, Tohari. 2014. Analisis Serta Perancangan Sistem Informasi Melalui Pendekatan UML. Andi Offset , Yogyakarta.

[6] Karlina; Muslihudin. M. Sistem Pendukung Keputusan Penilaian Kinerja Staf Kantor Bupati Pringsewu Menggunakan Fuzzy Multiple Attiribute Decision Making, Jurnal TEKNOINFO, Vol. 12, No. 2, 2018, 76-81, ISSN 2615-224X.

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[7] Karsa, Sigit Eka; Devitra, Joni. Analisis Dan Perancangan SPK Pemilihan Pns Teladan Dengan Metode SAW Pada BKD Provinsi Jambi. Jurnal Manajemen Sistem Informasi, [S.l.], v. 2, n. 2, p. 483-493, june 2017. ISSN 2548-5873.

[8] Kristiana, Titin. "Penerapan Profile Matching untuk Penilaian Kinerja Pegawai Negeri Sipil (Pns)." Pilar Nusa Mandiri, vol. 11, no. 2, Sep. 2015, pp. 161-170.

[9] Pramudita. D.A; Christy. R. Sistem Pendukung Keputusan Untuk Penilaian Rumah Sakit Terbaik Di Lampung Tengah Menggunakan Metode AHP, JDMSI, Vol. 1, No. 2 , 2020, 10-18. ISSN 2745-8458 (print), ISSN 2775-9660 (online).

[10] Munthafa. A. E; Mubarok. H, Penerapan Metode Analytical Hierarchy Process Dalam Sistem Pendukung Keputusan Penentuan Mahasiswa Berprestasi, Jurnal Siliwangi Vol.3. No.2, 2017. ISSN 2477-3891.

[11] Rachman, R. Penerapan Metode AHP Untuk Menentukan Kualitas Pakaian Jadi di Industri Garment, JURNAL INFORMATIKA, Vol.6 No.1 April 2019, pp. 1~8. ISSN: 2355-6579, E-ISSN: 2528-2247.

[12] Rahmawati. N. A dan Bachtiar. A. C. Analisis dan perancangan desain sistem informasi perpustakaan sekolah berdasarkan kebutuhan sistem, Berkala Ilmu Perpustakaan dan Informasi, Vol. 14, No. 1, Juni 2018, Hal. 76-86DOI: 10.22146/bip.28943ISSN 1693-7740 (Print), ISSN 2477-0361 (Online).

[13] Rianto, B. Sistem Pendukung Keputusan Penerimaan KaryawanMenggunakan Metode Analytical Hierarchy Process (AHP)Studi Kasus : RB. Nilam Sari Tembilahan, Riau Journal Of Computer ScienceVol.2 No.2 Tahun 2016 : 29 – 38.

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