

Implementation Of The Multi-Attribute Utility Theory (Maut) Algorithm In The Web-Based Performance Evaluation System For The Administrators Of Nurul Hayah Islamic Boarding School

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Abstrak

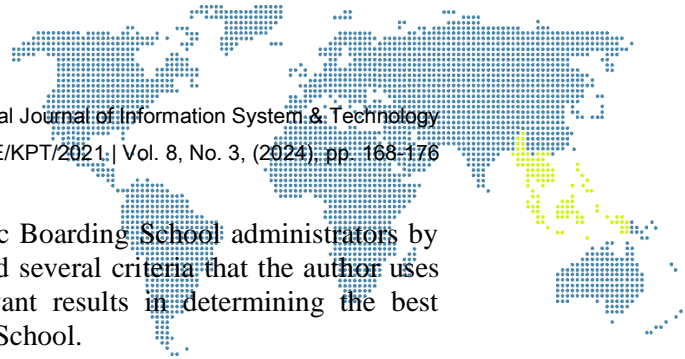
Islamic Boarding School as an educational institution that focuses on character, moral, and religious formation that has an organizational structure involving many administrators with their respective roles and responsibilities. With this, an Islamic boarding school must improve the quality of management of the administrators by evaluating the performance of the administrators. In this study, we tried to select the best administrators at the Nurul Hayah Islamic Boarding School using the Multi-Attribute Utility Theory (MAUT) method. I used five main assessment criteria: discipline, loyalty, accountability, leadership, and educational background. To build the system, I applied the Extreme Programming (XP) methodology with the PHP programming language, MySQL database, and Visual Studio Code development environment. The sample was obtained from the data of the administrators of the education section of the Nurul Hayah Islamic Boarding School. With the weights that have been determined for each criterion, this study successfully identified Dimas as the administrator with the best performance, and obtained a score of 14.6667 as the best administrator at the Nurul Hayah Islamic Boarding School. With this, it is stated that the study using the MAUT method to determine the best administrator was successful.

Keywords: Extreme Programming, Multi Attribute Utility Theory, Performance Assessment, Management, Islamic Boarding School

1. Introduction

Information technology is developing rapidly in today's digital era. Various aspects of life can be supported and facilitated by technology and information systems [1]. One of the Islamic Boarding Schools in Brebes Regency is the Nurul Hayah Islamic Boarding School located in Bulakelor Village, Keuhanan District, Central Java Province. This Islamic school plays an important role in raising a young generation with high morals. This Islamic boarding school strives to produce a generation of individuals who are well-mannered, disciplined, have strong moral principles, and have a strong sense of social responsibility in addition to providing religious education. However, it is not uncommon for Islamic boarding schools to experience obstacles in determining the best administrators who are able to carry out their duties optimally. This system is made Web-based of course for ease of access [2].

One thing that often hinders the effectiveness of Islamic boarding school management is inaccurate performance assessment. A system that supports managerial decision making in a semi-structured state is known as a decision support system. [3]. The Application of Analytical Hierarchy Process (AHP) and Simple Additive Weight (SAW) Methods in the Selection of the Best Employees at the Surya Kencana Savings and Loan Cooperative is the title of the research that the author quotes [4]. The SAW method is used to sort employees and summarize data, while the AHP method determines the weight of each criterion. Although effective in the context of cooperatives, however. This research is different from the management of Islamic Boarding Schools which are more complex and structured. In this study, the author chose the MAUT Method because it is more



appropriate for assessing the performance of Islamic Boarding School administrators by considering subjective aspects such as discipline and several criteria that the author uses as an assessment. So that it provides more relevant results in determining the best administrators at the Nurul Hayah Islamic Boarding School.

2. Research Methodology

Primary data from Nurul Hayah Islamic Boarding School were obtained directly and used in this study. The research stages include identifying problems, collecting data analyze data, and draw findings and conclusions. As seen in the figure, compiling the report is the final step.

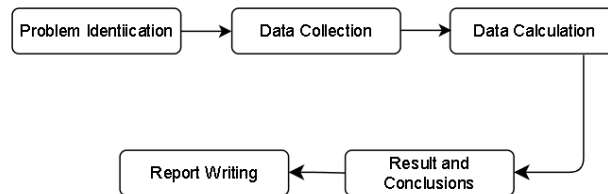


Figure 1. Research Methods

2.1. Problem Identification

Islamic boarding school facing problems in assessing the performance of management which is currently unstructured and still subjective [5]. The absence of a criteria-based assessment system clearly causes injustice and a lack of transparency in determining the best management. For this reason, a solution is needed in the form of implementing the MAUT algorithm as an objective and automated assessment system that is able to assess management performance based on various predetermined attributes.

2.2. Data Collection

One of the steps in the research process that aims to collect information from a population is data collection [6]. Interviews with the head of the Nurul Hayah Islamic Boarding School foundation were used to collect data for this study. Based on the findings of the interview with the head of the Islamic boarding sch

2.3. Data Calculation

Currently, the Multi-Attribute Utility Theory (MAUT) algorithm is used for data analysis [7]. A scheme known as Multi Attribute Utility Theory (MAUT) is used to perform the final evaluation, $x(x)$. Using a range of 0–1, where 0 indicates the worst choice and 1 indicates the best value, MAUT converts different preferences into numerical values. This method allows direct comparison between different measures [8]. The calculation process can be explained through several equations formulated as follows:

- a) Set the criteria and their respective weights; the total weight value must be equal to 1.

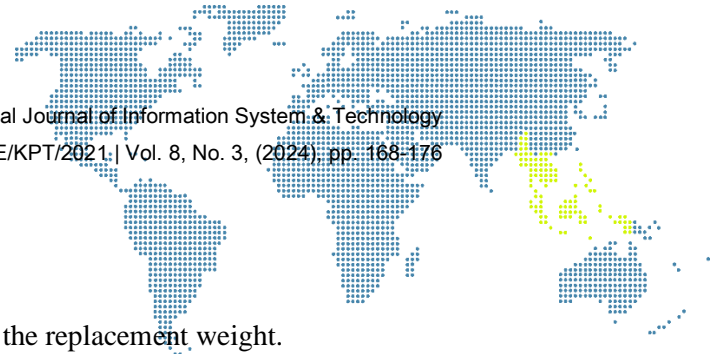
$$\sum_{i=1}^n w_i = 1 \tag{1}$$

Information:

W_i = Criteria weight

- b) Building a Normalized Matrix

$$U(x) = \frac{(x - x_i^-)}{(x_i^+ - x_i^-)} \tag{2}$$



Information :

Normalized alternative weights ($U(x)$)

x_i^- = Minimum open weight criteria value

x_i^+ = Best weight (maximum criteria value) x is the replacement weight.

c) Determining Preference Values

$$V(x) = \sum_{i=1}^n W_i \cdot V_i(x) \tag{3}$$

Information :

$V(x)$ = preference (evaluation value of an object, i)

W_i = criteria weight

N = number of components or requirements

I = total weight is one.

Where $v_i(x)$ is the evaluation value for the i -th object, and w_i is the weight indicating the level of importance of the i -th element compared to other elements. Meanwhile, n represents the total number of elements, with the sum of the weights must be equal to 1.

2.4. Results and Conclusions

At this point, conclusions are drawn based on each result and action that has been taken [9]. Interview with the head of the Nurul Hayah Islamic Boarding School foundation to find out the criteria and weights that are then used for assessment. The calculation of preference values and normalization is carried out with the help of the MAUT algorithm and the decision matrix (X). This procedure produces a ranking, and the best alternative solution is determined by applying the SAW method to the highest ranking value

2.5. Writing Reports

The final step involves writing a report that summarizes the entire research procedure and findings conducted. This report provides a thorough explanation, outlining everything from the author's challenges to the findings and recommendations of the investigation.

2.6. System Development Methods

Extreme Programming is a technique used [10]. Approach, system development, and interface are needed when creating a system or application to ensure the completion process of software engineering. The Extreme Programming model is a system approach used in this study [11]. The XP technique takes a sensitive attitude to change [12]. This approach is a component

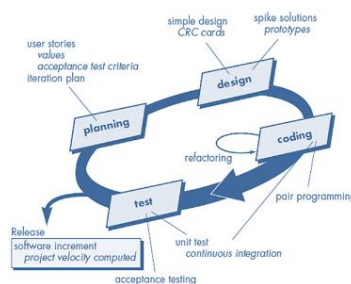
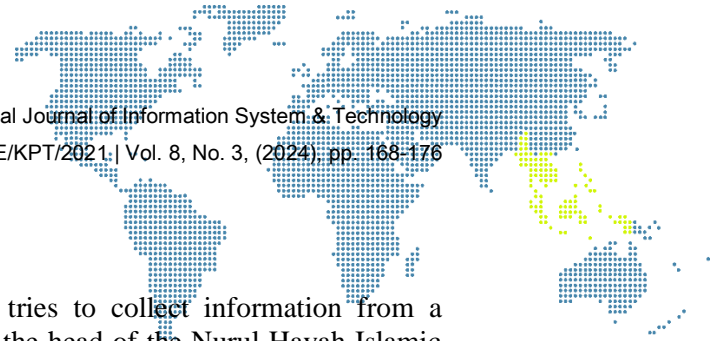


Figure 2. Extreme Programming Method

Agile project management methodology, which emphasizes simplicity and speed. The Extreme Programming approach is used in the development process of this data processing system software [12].



3. Result and Discussion

3.1. Data Collection

One of the steps in the research process that tries to collect information from a population is data collection [6]. An interview with the head of the Nurul Hayah Islamic Boarding School foundation was conducted to collect data. The MAUT algorithm was then used to process the collected data and determine optimal management options.

Table 1. Data Collection

No	Name	Nik	Address	Department
1	Saeiful	1907411010	Brebes	Chairman
2	Haris	1907411001	Cirebon	Treasurer
3	Alfiah	1907411003	Brebes	Secretary
4	Windy	1907411002	Brebes	Security
5	Hilmi	1907411004	Bogor	Cleanliness
6	Zahra	1907411005	Pemalang	Health
7	Iqbal	1907411007	Bandung	Ubudiyah
8	Apip	1907411008	Brebes	Ubudiyah
9	Akmal	1907411009	Brebes	Representative
10	Dimas	1907411015	Bekasi	Education

3.2. MAUT Method Calculation

The results of the calculation of the weight of the MAUT method criteria will be obtained. The final result is a ranking of the best administrators based on all criteria [13]. The best administrators are identified using criteria obtained from the findings of observations and interviews conducted. The standards are shown in Table 2. The MAUT algorithm starts by finding the MAUT weights and criteria, as mentioned below:

a) Criteria

Table 2. Criteria

Code	Criteria	Weight
C1	Discipline	5
C2	Loyalty	2
C3	Accountability	4
C4	Leadership	4
C5	Educated	3
Total		18

The value will then be ascertained using the following indicators:

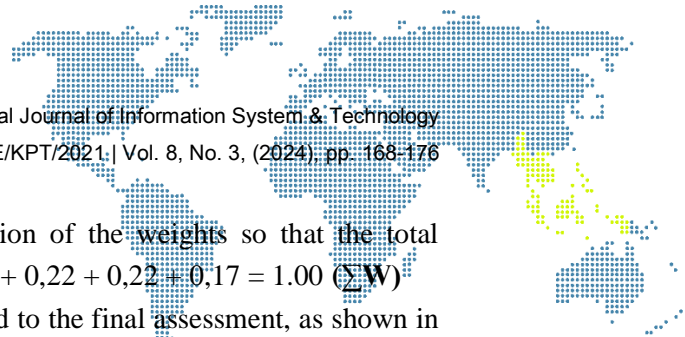
Table 3. Assessment Indikator

Indicator	Mark
Very good	5
Good	4
Enough	3
Bad	2
Very bad	1

Next, the weight will be normalized so that the value becomes 1

Table 4. Normalization of Weight = 1

Factor	C1	C2	C3	C4	C5	$\sum W$
Weight	0.28	0.11	0.22	0.22	0.17	1.00



The following is the calculation of the normalization of the weights so that the total becomes 1. ex: $C1 = \frac{5}{18} = 0,28$ didapat $0,28 + 0,11 + 0,22 + 0,22 + 0,17 = 1.00 (\sum W)$

Once determined, the indicator values will be applied to the final assessment, as shown in the table below:

Table 5. Management Value Data

Alternative	C1	C2	C3	C4	C5
A1	2	5	3	5	4
A2	3	3	4	2	3
A3	2	4	3	4	2
A4	5	3	4	3	5
A5	4	3	4	4	4
A6	2	5	2	4	5
A7	3	4	2	3	2
A8	3	4	3	3	3
A9	4	3	3	5	5
A10	5	4	4	4	4

Furthermore, The maximum and minimum of each established criteria, the maximum and minimum values obtained are as follows: Table 6. Max and Min Values of Criteria with determine mark

Table 6. Max and Min Values of Criteria

A-	2	3	2	2	2
A+	5	5	4	5	5

Therefore, the Maximum and Minimum values of the following criteria are ensured:

C1 = 5, C2 = 5, C3 = 4, C4 = 5, C5 = 5 maximum values.

C1 = 2, C2 = 3, C3 = 2, C4 = 2, and C5 = 2 are the minimum values.

Next, normalize the matrix for each administrator, using the following formula (2)

a) Alternative Name: Saeful (A1)

$$A1_5 = \frac{4-2}{5-2} = \frac{2}{3} = 0.667$$

Results displayed in the form of a table that includes 10 alternative administrators that have been selected, as follows:

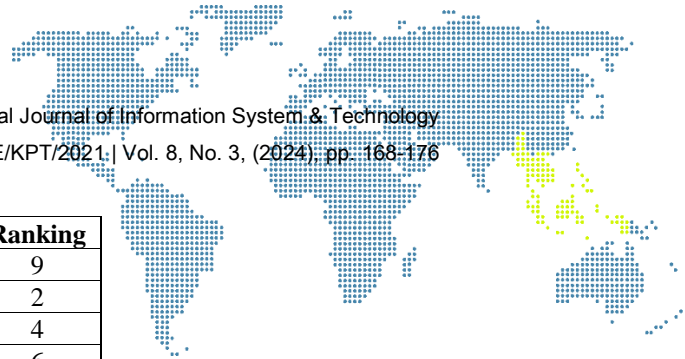
Table 7. Normalization of Assessment Matrix

Alternatif	C1	C2	C3	C4	C5
A1	0	1	0.5	1	0.6667
A2	0.3333	0	1	0	0.3333
A3	0	0.5	0.5	0.6667	0
A4	1	0	1	0.3333	1
A5	0.6667	0	1	0.6667	0.6667
A6	0	1	0	0.6667	1
A7	0.3333	0.5	0	0.3333	0
A8	0.3333	0.5	0.5	0.3333	0.3333
A9	0.6667	0	0.5	1	1
A10	1	0.5	1	0.6667	0.6667

The next stage will be to calculate the preference or evaluation value using the formula (3). Example calculation of alternative 1 (A1) is used to determine the preference value based on the equation above. The method used to calculate option 1 (A1) is also used to calculate the other alternatives. Table 6 shows the results of the overall preference value calculation.

Table 8. Preference Values

Alternatif	C1	Ranking
A1	10.0000	5
A2	6.6667	8



Alternatif	C1	Ranking
A3	5.6667	9
A4	13.3333	2
A5	12.0000	4
A6	7.6667	6
A7	4.0000	10
A8	7.0000	7
A9	12.3333	3
A10	14.6667	1

Based on the calculations carried out using the MAUT algorithm, the results obtained were that the highest preference value was Dimas (A10) with a value of 14.6667, while the lowest preference value was A7 with a value of 4.0000.

3.3. Design (System Design)

Use case diagrams, which display admin and user as the two actors, are used to design the system.

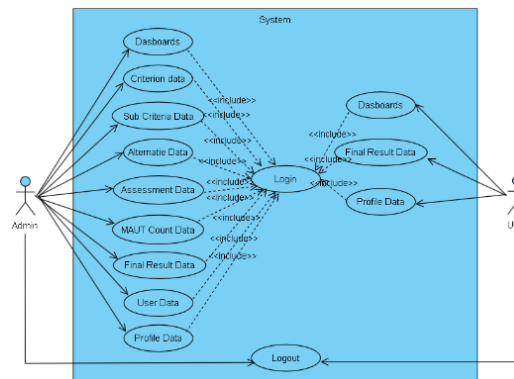


Figure 3. Use Case Diagram

3.4. System Implementation

Implementing the designed software into practice is the next step. The PHP programming language, MySQL database, and Visual Studio Code tools are used by the author in the system design section.

a) Login Page View

Figure 4 shows the login screen. system. To access the Dashboard, The administrator or user must first fill in this page with his/her username and password.



Figure 4. Login Page

b) Dashboard Page View System dashboard

Depicted in Figure 5 and contains a number of important elements such as criteria and subcriteria data, alternative data, assessment data, MAUT method calculation result data, and final result data arranged sequentially.

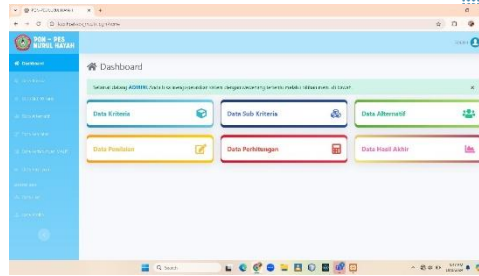
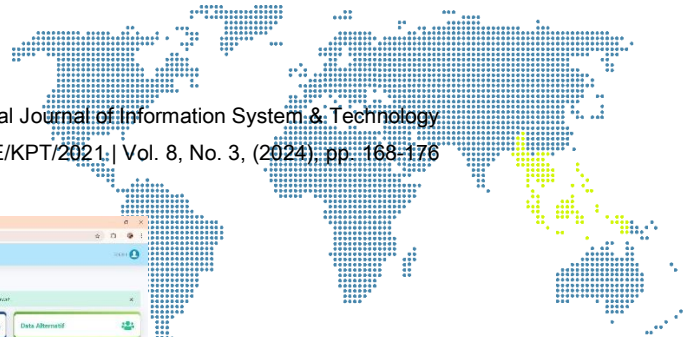


Figure 5. Dashboard Page

c) Criteria Data Page View

The list of criteria used to evaluate management performance is displayed on the Criteria Data page. Each criterion is displayed in a table format with a column for the criterion name and weight, indicating the relative importance of that criterion during the assessment process.

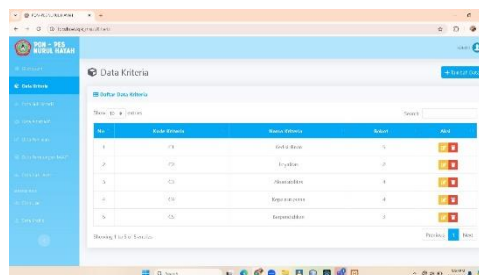


Figure 6. Criteria Data Page

d) Calculation Data Page View

The results of the assessment calculations carried out using the MAUT algorithm are displayed on the Calculation Data page. The alternative name (administrator), the value of each criterion, the utility value of each criterion multiplied by the weight, and the total score of each administrator are in the columns in this table. The overall score is automatically determined by the system by dividing the weight of each criterion.

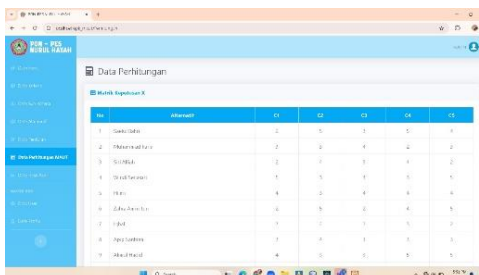
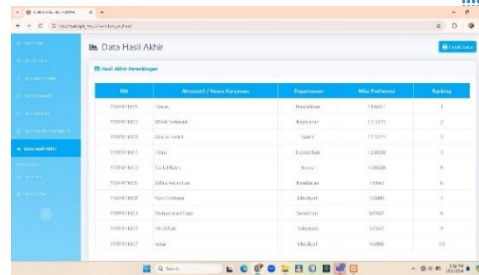


Figure 7. Calculation Data Page

e) Final Result Data Page View Management ranking

Determined based on the total score is displayed on the Final Result Data page, along with a summary of the final scores of the management performance assessment. The columns that include the total score, ranking, and alternative name (management) are in the table. To show who has the best management performance, the ranking is determined from the highest to the lowest score.



ID	Nama	Posisi	Nilai Akhir	Ranking
100001	Dimas	Presiden	14.6667	1
100002	Wahid Wahid	Wakil Ketua	13.3333	2
100003	Wahid Wahid	Wakil	13.3333	3
100004	Wahid	Wakil Ketua	12.0000	4
100005	Wahid Wahid	Wakil	10.0000	5
100006	Wahid Wahid	Wakil	10.0000	6
100007	Wahid Wahid	Wakil	10.0000	7
100008	Wahid Wahid	Wakil	10.0000	8
100009	Wahid Wahid	Wakil	10.0000	9
100010	Wahid Wahid	Wakil	10.0000	10

Figure 8. Final Result Data Page

4. Conclusion

In this study, the implementation of the MultiAttribute Utility Theory (MAUT) algorithm for the performance assessment of the management of the Nurul Hayah Islamic Boarding School showed significant results in determining the best management based on relevant criteria. The findings that the author cited in the journal article "Implementation of the MAUT Method in the Selection of the Best Employees at the Medan City Land Office" are in line with these results [15]. Which also uses the MAUT method in the context of the best employee assessment, where they reported increased. The study shows that the use of the Extreme Programming (XP) system development method and the Multi-Attribute Utility Theory (MAUT) algorithm to evaluate the performance of the Nurul Hayah Islamic Boarding School administrators has produced measurable and objective results. Each of the five main criteria used in this study has a weight based on how important the criteria are. For example, because discipline is considered a major component of management performance, discipline gets the highest weight, which is 5. The calculation results show that the best administrator scored 14.6667 in the name of Dimas. Thus, this administrator performance assessment system has succeeded in identifying the best performing administrators, as well as providing a strong basis for improving the quality of management and transparency in future assessment processes.

References

- [1] A. Harjanta and F. Dewanto, "Rancang Bangun Sistem Informasi Penghitungan Pajak Penghasilan (PPh) Pegawai UPGRIS Berbasis Web," *J. Inform. UPGRIS*, vol. 1, no. 2, pp. 152–158, 2015.
- [2] M. Jasri and A. F. Ghazali, "Klasifikasi Nilai Pengurus Teladan Pondok Pesantren Nurul Jadid Menggunakan Metode K-Nearest Neighbor (KNN)," *SMARTICS J.*, vol. 10, no. 1, pp. 13–20, 2024, [Online]. Available: <https://ejournal.unikama.ac.id/index.php/jst/article/view/9913>
- [3] M. S. Ogansyah, A. Diana, H. Patrie, and B. T. Sartana, "Penerapan Metode Analytical Hierarchy Process (AHP) Dan Simple Additive Weighting (SAW) Dalam Pemilihan Karyawan Terbaik Pada Koperasi Simpan Pinjam Surya Kencana," *Bit (Fakultas Teknol. Inf. Univ. Budi Luhur)*, vol. 20, no. 1, p. 1, 2023, doi: 10.36080/bit.v20i1.2217.
- [4] S. Rihastuti, "Penerapan Metode Multi Attribute Utility Theory dalam Pemilihan Karyawan Terbaik di STMIK Amikom Surakarta," *J. Ilm. IT CIDA*, vol. 5, no. 2, pp. 1–11, 2020, doi: 10.55635/jic.v5i2.108.
- [5] K. Rizki and P. D. Mardika, "Mutasi Karyawan Menggunakan Algoritma Maut di Balitbang KEMHAN," *J. Ris. dan Apl. Mhs. Inform.*, vol. 5, no. 1, pp. 154–163, 2024, doi: 10.30998/jrami.v5i1.10440.
- [6] I. T. Silitonga, M. Syahril, and A. Calam, "Penerapan Metode MAUT Untuk Menentukan Kader Partai Terbaik," *J. Sist. Inf. Triguna Dharma (JURSI TGD)*, vol. 1, no. 4, p. 332, 2022, doi: 10.53513/jursi.v1i4.5393.



- [7] A. Aldiannur, A. J. Latipah, and A. Arbansyah, "Penerapan Algoritma Maut Dalam Menentukan Lulusan Terbaik Profesi Ners Umkt," *J. Sains Komput. dan Teknol. Inf.*, vol. 5, no. 2, pp. 54–58, 2023, doi: 10.33084/jsakti.v5i2.5009.
- [8] I. Carolina, A. Supriyatna, J. Kamal Raya No, and R. Barat Cengkareng Jakarta Barat, "Penerapan Metode Extereme Programming dalam Perancangan Aplikasi Perhitungan Kuota SKS Mengajar Dosen," *IKRA-ITH Inform. J. Komput. dan Inform.*, vol. 3, no. 1, pp. 106–113, 2019, [Online]. Available: <https://journals.upi-yai.ac.id/index.php/ikraith-informatika/article/view/306>
- [9] N. Q. Nada, M. W. I. Fahmi, and A. T. J. Harjanta, "Aplikasi Monitoring Kinerja Pegawai Menggunakan Algoritma Simple Additive Weighting (Saw) Di Badan Pusat Statistik Kabupaten Pati Berbasis Mobile," *J. Inform. Upgris*, vol. 6, no. 2, pp. 86–93, 2020, doi: 10.26877/jiu.v6i2.8240.
- [10] F. S. Mawinar, R. D. Gunawan, and A. T. Priandika, "Sistem Pendukung Keputusan Pemilihan Pegawai Honorer Terbaik Menggunakan Metode Visekriterijumsko Kompromisno Rangiranje," *J. Data Sci. Inf. Syst.*, vol. 1, no. 4, pp. 182–191, 2023, [Online]. Available: <https://doi.org/10.58602/dimis.v1i4.81>
- [11] R. A. I. Sadarang, A. S. Adha, S. Syahrir, A. M. HR.Lagu, M. F. Pahrir, and A. S. A. Ishak, "Pemanfaatan Sistem Open Data Kit Sebagai Media Pengumpulan Data," *J. Inf. Syst. Applied, Manag. Account. Res.*, vol. 5, no. 1, p. 94, 2021, doi: 10.52362/jisamar.v5i1.344.
- [12] M. Agnitia LEstari, M. Tabrani, and S. Ayumida, "Sistem Informasi Pengolahan Data Administrasi Kependudukan Pada Kantor Desa Pucung Karawang," *J. Interkom J. Publ. Ilm. Bid. Teknol. Inf. dan Komun.*, vol. 13, no. 3, pp. 14–21, 2021, doi: 10.35969/interkom.v13i3.50.
- [13] R. Sri Hayati, S. Lestari Rahayu, A. Sanjaya, P. Studi Informatika, P. Studi Rekayasa Perangkat Lunak, and P. Studi Informatika, "Pemilihan Susu Formula Menggunakan Metode Multi Attribute Utility Theory (MAUT) Selection of Formula Milk Using the Method Multi Attribute Utility Theory (MAUT)," *InfoSys J.*, vol. 6, no. 1, pp. 42–51, 2021.