International Journal Science and Technology

IJST Vol 2 No. 3 | Nov 2023 | ISSN: 2828-7223 (print), ISSN: 2828-7045 (online), Page 49-56

IMPLEMENTATION OF SIMPLE ADDITIVE WEIGHTING (SAW) METHOD FOR DESIGN AND BUILD DECISION SUPPORT SYSTEM OF LAPTOP SELECTION (Case Study: IT Store)

Gregorius Hariyanto Setiadi[1], Fenina Adline Twince Tobing[2]*, Rena Nainggolan[3]
[1,2]Department of Informatics, Multimedia Nusantara University, Indonesia
[3]Department of Computerized Accounting, Indonesian Methodist University, Indonesia

Article History
Received : Nov 2023
Revised : Nov 2023
Accepted : Nov 2023
Published : Nov 2023

Corresponding author*:
fenina.tobing@umn.ac.id

Cite This Article:
G. Hariyanto Setiadia, F. Adline Twince Tobing, and R. Nainggolan, "IMPLEMENTATION OF SIMPLE ADDITIVE WEIGHTING (SAW) METHOD FOR DESIGN AND BUILD DECISION SUPPORT SYSTEM OF LAPTOP SELECTION (Case Study: IT Store)", IJST, vol. 2, no. 3, pp. 49–56, Nov. 2023.

DOI:
https://doi.org/10.56127/ijst.v2i3.999

***Abstract*:** A laptop is a small computer that is easy to carry anywhere, which makes everyone want to have one because of its convenience. However, the laptops currently available have various specifications, so users feel confused about choosing and buying the laptop they want. Therefore, this research was conducted to build a web-based decision-support system. The method used in this decision support system is simple additive weighting as a criterion for calculating laptop recommendations. The SAW method is a weighted addition method to determine the weighted sum to determine ranking. User satisfaction test results using a questionnaire using the End User Computing Satisfaction (EUCS) method The results of the calculation of the user satisfaction test obtained a result of 85.66%, which means that the system built can be useful for users in providing laptop recommendations.

***Keyword*:** Codeigniter, EUCS, Laptop, Recommendation system, SAW.

INTRODUCTION

A laptop is an electronic device that has a system that is capable of manipulating data accurately and quickly and is designed specifically to store data that is input automatically by carrying out steps that have been inserted into the computer system (Donald H. Sanders). Nowadays, the use of laptops has become one of the primary needs of society, especially for students during the pandemic. Based on data from analyst company Canalys, laptop shipments in the 2-2021 quarter increased by 13% percent (indozone.id, 2021). The laptop manufacturer brands that occupy the top marks in the research results conducted by Canalys in the 2-2021 quarter are Lenovo, HP, Dell, Apple, and Acer (indozone.id, 2021). Each quite varied laptop brand has various specifications as well as various features that can meet the needs of today's consumers. In Tangerang, there are more than 15 shops selling various types of laptops. Based on the results of interviews conducted with salespeople, the results obtained were that each consumer needed quite a long time to determine a laptop that suited their needs. This is because there are many types of laptops with various specifications available. Thus, it can cause confusion for consumers in determining which laptop suits their needs.

There are several benefits from a laptop selection decision support system, namely helping determine decisions, reducing decision-making errors, decision management, saving time, and increasing satisfaction with decision-making in choosing the right laptop. Therefore, it is necessary to create a support system that can support consumers' decisions in choosing a laptop that suits their wishes. A group of procedures that carry out data processing with the aim of assisting users in making specific decisions is called a decision support system [1]. A decision support system is a computer-based system consisting of three interacting components: a language system, a knowledge system, and a problem processing system [2]. Decision support systems are designed to produce various alternatives offered to consumers.

Following are previous studies related to decision support systems, including similar research conducted by [3]. This research was carried out using the AHP method to calculate the value of each criterion using price, screen size, processor type, memory capacity, hard disk capacity, and accessories as calculation criteria from the test results carried out, which indicates that the system being built is useful for users who need laptop recommendations that match the desired criteria. Furthermore, research by [4]. This research proves

that using the simple additive weighting method can provide appropriate decision results based on specified criteria. Similar research was conducted by [5], [6], [7], [8], [9], [10], [11], and [12]. Research with system results can provide laptop recommendations according to consumer needs using the SAW method. The difference between the research and this research is that it is a different case study with different criteria, and there is no decision support system for selecting laptops in the IT Store that uses the Simple Additive Weighting (SAW) algorithm.

Therefore, this research aims to create a decision support system for selecting laptops in IT stores. Because in the IT Store, there are many laptops with different brands and specifications. This decision support system uses the Simple Additive Weighing (SAW) method, known as the weighted addition method. This method is often used in dealing with Multiple Attribute Decision Making (MADM) situations [13]. The basic concept of the SAW method is to find the weighted sum of the performance ratings for each alternative from all attributes [14]. The advantage of using the SAW method compared to other decision-making methods is that this method can make more precise assessments based on predetermined criteria values and preference weights [15]. Based on these advantages, the simple additive weighting method is applied. Simple Additive Weighting (SAW), also known as the weighted addition method, is a method used for decision-making [10]. For this research, one shop, namely the IT Store, was taken as a case study at Supermall Karawaci E-Center Tanggerang as a sample, and then a satisfaction test was carried out.

RESEARCH METHODOLOGY

The research stages carried out in this research are :

1. Literature studies begin with searching and learning from various sources, such as books, ebooks, scientific journals, articles, and direct interviews.
2. Data collection was carried out at the IT Store in Tangerang, taken via the official website owned by each brand.
3. Application design consists of creating a sitemap, use case diagram, data flow diagram (DFD), flowchart, database schema, user interface design, and database structure.
4. Implementation is carried out to build a decision support system that is made in accordance with the application design that has been created previously. The programming language used is PHP with the Codeigniter 4 framework using a MySQL database.
5. Application testing is carried out to see whether the results of manual calculations are the same as those implemented in the application or not.
6. User satisfaction testing is carried out by distributing questionnaires that have implemented the EUCS (End User Computing Satisfication) method to application users.
7. Report writing is designed to create documentation of this research from the design stage to the implementation stage. In writing this report, it also contains suggestions for future developments.

In this research, there is a user sitemap that has several main pages, as shown in the following image :

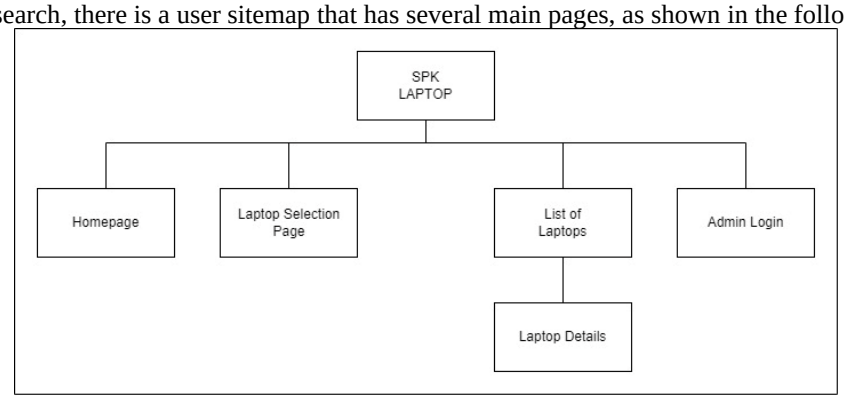

Fig.1. User page sitemap

On the user page, the homepage is the page that will appear first when accessing the application. On the homepage, users can see the initial display of this application. On the laptop selection page, users can select the laptop they want based on the criteria provided. The last section is the laptop list page. On this page users can see various variations of laptops available on the system. The last section is the admin login page. On this page, admins can log in to the admin page.

Flowcharts are used to simplify and describe a series of processes in a system. The following is an image of the recommended flowchart :

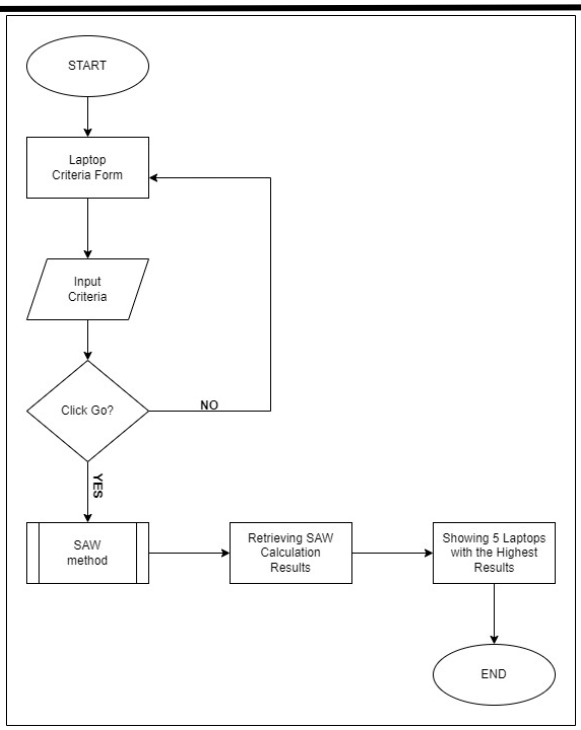

Fig.2. User recommendation flowchart

The user will then be given criteria that they can fill in. After pressing the go button, a calculation process will be carried out based on the user's desired criteria using the SAW method. Once completed, the system receives the SAW calculation results and displays the five laptop data points with the highest values.

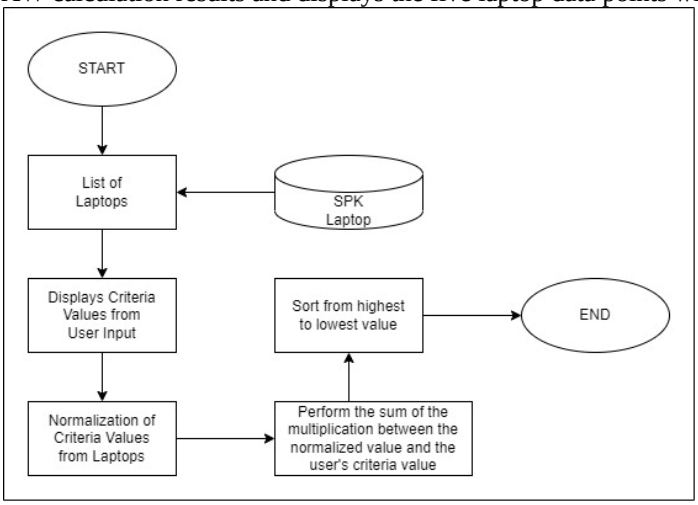

Fig.3. SAW method flowchart

Initially, the system takes registered laptop data and assesses criteria derived from user input. After that, the values in the laptop list are normalized. After normalization is complete, the system will multiply the normalization results with the user's criteria values. After that, the results of the multiplication will be added together to become one. Then the sum results are sorted from largest to smallest value.

RESULT AND DISCUSSION

In carrying out research, several tools are used to support the implementation of research, both hardware and software. The Simple Additive Weighing method requires a process of normalizing the decision matrix (X) to a scale that can be compared with all existing alternative ratings. The following is the formula for normalization :

$$r_{ij} = \begin{cases} \dfrac{x_{ij}}{Max\ x_{ij}} \ if\ j\ is\ the\ profit\ attribute\ (benefit) \\ \dfrac{Minx_{ij}}{x_{ij}} \ if\ j\ is\ the\ cost\ attribute\ (cost) \end{cases}$$

Information :

r_{ij} = normalized performance rating value.
x_{ij} = attribute value for each criterion.
$Max\ x_{ij}$ = largest value of each criterion i
$Minx_{ij}$ = smallest value of each criterion i

The preference value for each alternative (V_i) is given as follows :

$$V_i = \sum_{j=1}^{n} w_j r_{ij}$$

Information :

V_i = ranking for each alternative.
w_j = weight value for each criterion.
r_{ij} = normalized performance rating value

The following is an example of a calculation to determine laptop ranking based on criteria that the user has specified :

Table 1. Laptops with Criteria Weights

Laptop	Price	GPU	Processor	Memory Capacity	RAM
Asus	5	1	3	1	1
Lenovo	4	2	2	1	3
Acer	2	3	1	2	2
Dell	3	2	3	3	3
Apple	1	3	1	4	4

In Table 1, the price criteria include the cost attribute, and the GPU, processor, memory capacity, and RAM criteria include the benefit attribute. The assessment weights determined by the user are price, GPU, processor, memory capacity, and RAM. The next stage is normalization. At this stage, the benefit and cost attributes have different formulas. For benefit attributes, the attribute value for each criterion will be divided by the highest value for each criterion. For the cost attribute, the smallest value of each criterion will be divided by the attribute value of each criterion.

Table.2 Normalization Results

Laptop	Price	GPU	Processor	Memory Capacity	RAM
Asus	0.2	0.33	1	0.25	0.25
Lenovo	0.25	0.67	0.67	0.25	0.25
Acer	0.5	1	0.67	0.5	0.5
Dell	0.33	0.67	1	0.75	0.75
Apple	1	2	0.33	1	1

The next stage is a ranking process with weights based on user input. The weights specified by the user are W = 4,2,3,3,3.

Table 3. Ranking Results

Laptop	Ranking Results	Ranking
Asus	5.96	4
Lenovo	5.85	5
Acer	9.01	3
Dell	10.16	2
Apple	15.33	1

Based on the ranking results in Table 3, the laptop that meets the user's criteria is an Apple laptop.

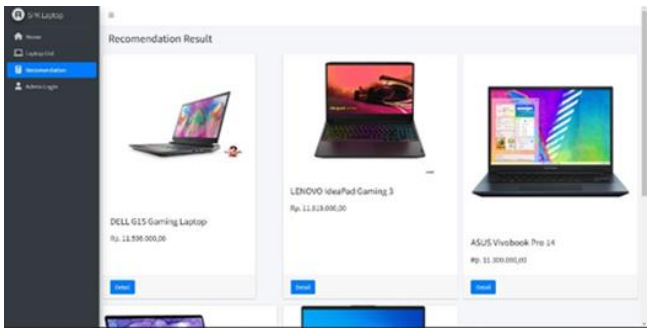

Fig.4. User recommendation results page

Figure 4 is the implementation result of the user interface design for the user recommendation results page. This page functions to display the results of laptop recommendations that match the criteria entered by the user previously. Users can press the details button to find out laptop information from the recommendation results.

Test System Success

The testing was carried out by distributing questionnaires using Google Forms. The questions contained in the questionnaire refer to the End User Computing Satisfaction (EUCS) method, which is a method used to measure the level of satisfaction of users of an application system by comparing it with the expectations and reality of an information system [16]. In this method, there are five dimensions to the questions contained in the questionnaire: content, accuracy, format, ease of use, and timeliness. Table 4 is a list of questions contained in the questionnaire distributed.

Table 4. Table listing questionnaire results

No	Question	SS	S	N	TS	STS
1	Does the information on this system comply with your needs?	19	34	5	0	0
2	Can this system present information clearly and completely?	17	36	5	0	0
3	What are the results of the recommendations given in is this system accurate for your needs?	20	34	4	0	0
4	Is the distribution of criteria in this system for accurate recommendations?	21	26	10	1	0
5	The design and format provided in this system make it easier for users?	21	23	12	2	0
6	Can the menu structure and options in this system design be understood easily?	23	31	2	2	0
7	Is this system easy to use?	28	29	0	1	0
8	Can this system be accessed anywhere and at any time?	33	24	1	0	0
9	Does the system save you time in searching for the laptop you need?	19	31	7	1	0
10	Does this system display information quickly?	28	25	5	0	0

Next, percentage calculations will be carried out for each dimension. This percentage calculation is carried out using the Likert scale formula with a scale value of 5-1.

Content

The percentage calculation in question number 1 is calculated using the following formula :

$$Score\ Percentage = \frac{(19 \times 5) + (34 \times 4) + (5 \times 3) + (0 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 84.83\%$$

The percentage calculation in question number 2 is calculated using the following formula :

$$Score\ Percentage = \frac{(17 \times 5) + (36 \times 4) + (5 \times 3) + (0 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 84.14\%$$

The final percentage of the content dimension is obtained from the percentage results of the two previous questions using the following formula :

$$Final\ Score\ Percentage = \frac{84.83 + 84.14}{2} = 84.48\%$$

With the final percentage obtained at 84.48%, it can be concluded that users strongly agree with the system that it has fulfilled the content dimensions.

Accuracy

The percentage calculation in question number 3 is calculated using the following formula :

$$Score\ Percentage = \frac{(20 \times 5) + (34 \times 4) + (4 \times 3) + (0 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 85.52\%$$

The percentage calculation in question number 4 is calculated using the following formula :

$$Score\ Percentage = \frac{(21 \times 5) + (26 \times 4) + (10 \times 3) + (1 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 83.10\%$$

The final percentage of the accuracy dimension is obtained from the percentage results of the two previous questions using the following formula :

$$Final\ Score\ Percentage = \frac{85.52 + 83.10}{2} = 84.31\%$$

With the final percentage obtained at 84.31%, it can be concluded that the user strongly agrees with the system that it has met the accuracy dimensions.

Format

The percentage calculation in question number 5 is calculated using the following formula :

$$Score\ Percentage = \frac{(21 \times 5) + (23 \times 4) + (12 \times 3) + (2 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 81.72\%$$

The percentage calculation in question number 6 is calculated using the following formula :

$$Score\ Percentage = \frac{(23 \times 5) + (31 \times 4) + (2 \times 3) + (2 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 85.86\%$$

The final percentage of the format dimension is obtained from the percentage results of the two previous questions using the following formula :

$$Final\ Score\ Percentage = \frac{81.72 + 85.86}{2} = 83.79\%$$

With the final percentage obtained at 83.79%, it can be concluded that the user strongly agrees with the system that it has met the format dimensions.

Ease of Use

The percentage calculation in question number 7 is calculated using the following formula :

$$Score\ Percentage = \frac{(28 \times 5) + (29 \times 4) + (0 \times 3) + (1 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 88.97\%$$

The percentage calculation in question number 8 is calculated using the following formula :

$$Score\ Percentage = \frac{(33 \times 5) + (24 \times 4) + (1 \times 3) + (0 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 91.03\%$$

The final percentage of the ease of use dimension is obtained from the percentage results of the two previous questions using the following formula :

$$Final\ Score\ Percentage = \frac{88.97 + 91.03}{2} = 90.00\%$$

With the final percentage obtained at 90.00%, it can be concluded that the user strongly agrees with the system that it has fulfilled the ease of use dimension.

Timeliness

The percentage calculation in question number 9 is calculated using the following formula :

$$Score\ Percentage = \frac{(19 \times 5) + (31 \times 4) + (7 \times 3) + (1 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 83.45\%$$

The percentage calculation in question number 10 is calculated using the following formula :

$$Score\ Percentage = \frac{(28 \times 5) + (25 \times 4) + (5 \times 3) + (0 \times 2) + (0 \times 1)}{58 \times 5} \times 100\% = 87.93\%$$

The final percentage of the timeliness dimension is obtained from the percentage results of the two previous questions using the following formula :

$$Final\ Score\ Percentage = \frac{83.45 + 87.93}{2} = 85.69\%$$

With the final percentage obtained at 85.69%, it can be concluded that users strongly agree with the system that it has met the timeliness dimension.

After calculating the percentage of each available dimension, the process of calculating the final percentage is then carried out based on the final percentage of each available dimension. The following is a calculation of system success :

$$Results = \frac{84.48 + 84.31 + 83.79 + 90.00 + 85.69}{5} = 85.66\ \%$$

So the conclusion that can be obtained is that users strongly agree that this laptop selection support decision support system is well built by obtaining a user satisfaction level of 85.66%.

CONCLUSION

The laptop search decision support system application has completed the design stage and has been built using the simple additive weighing method. The main function of this system is to search for laptop recommendations for users based on the criteria already available in it. The available criteria are price range, GPU, processor, RAM, and memory capacity, which can be adjusted to user needs. Scenario tests were also carried out in the SAW method calculations manually and through the system, with the results of the system working well. The results were carried out in the satisfaction test using the end-user computing satisfaction method using Google Form and obtained a percentage of 85.66%. According to the test results, this system can be used by users who need recommendations in choosing the desired laptop.

Acknowledgment

We would like to thank those who have helped with the financial support and facilities provided so that this research can be carried out well. We also express our deepest gratitude to Multimedia Nusantara University and all respondents who have completed this research questionnaire.

REFERENCES

[1] E. G. Wahyuni, "Sistem pendukung keputusan penerimaan pegawai dengan metode TOPSIS," *SITEKIN J. Sains, Teknol. dan Ind.*, vol. 14, no. 2, pp. 108–116, 2017.

[2] F. A. T. Tobing, M. I. Dzulhaq, and R. F. Sidiq, "Penerapan Metode Fuzzy AHP untuk Sistem Pendukung Keputusan Pemilihan Pemasok Terbaik," *Ultim. Comput. J. Sist. Komput.*, vol. 11, no. 2, pp. 90–94, 2019.

[3] S. H. Saragih, "Penerapan Metode Analitycal Hierarchy Process (AHP) pada Sistem Pendukung Keputusan Pemilihan Laptop," *Pelita Inform. Budi Darma*, vol. 4, no. 2, pp. 82–88, 2013.

[4] A. Setiadi, Y. Yunita, and A. R. Ningsih, "Penerapan metode simple additive weighting (SAW) untuk pemilihan siswa terbaik," *J. Sisfokom (Sistem Inf. dan Komputer)*, vol. 7, no. 2, pp. 104–109, 2018.

[5] D. Novianti and A. B. H. Yanto, "Sistem Penunjang Keputusan Pemilihan Laptop Menggunakan Metode Simple Additive Weighting," *J. Teknol. Inform. dan Komput.*, vol. 5, no. 2, pp. 70–75, 2019.

[6] H. Sukma, F. T. Tobing, and R. Nainggolan, "Sistem Pendukung Keputusan Dalam Pemilihan Hotel di Tangerang Menggunakan Metode AHP dan Topsis," *METHOMIKA J. Manaj. Inform. Komputerisasi Akunt.*, vol. 5, no. 1, pp. 67–72, 2021.

[7] C. A. D. Kirana and A. S. Harahap, "Pendukung Keputusan dalam Penilaian Pegawai Pemerintah Non Pegawai Negeri menggunakan Metode Entropy," *JURIKOM (Jurnal Ris. Komputer)*, vol. 9, no. 1, pp. 159–166, 2022.

[8] H. Nisa, F. Aulia, and A. Rayhan, "Kombinasi Metode Entropy dan Simple Additive Weighting

(SAW) dalam Pemilihan Dosen Pembimbing Skripsi," *J. Amplif. J. Ilm. Bid. Tek. ELEKTRO DAN Komput.*, vol. 12, no. 2, pp. 24–30, 2022.

[9] F. Fernando and F. A. T. Tobing, "RANCANG BANGUN WEBSITE SISTEM PENDUKUNG KEPUTUSAN KENAIKAN KELAS MENGGUNAKAN METODE AHP (STUDI KASUS: SMA TZU CHI CENGKARENG)," in *Seminar Nasional & Konferensi Ilmiah Sistem Informasi, Informatika & Komunikasi*, 2020, pp. 1003–1009.

[10] Y. M. Krisna, A. Kusnadi, and F. A. T. Tobing, "Recommendation System for Boarding House Selection using Simple Additive Weighting Method," 2023.

[11] M. A. Rupang and A. Kusnadi, "Implementasi Metode Entropy dan Topsis Dalam Sistem Pendukung Keputusan Pemilihan Karyawan Terbaik," *Ultim. Comput. J. Sist. Komput.*, vol. 10, no. 1, pp. 13–18, 2018.

[12] F. Imanuel and F. A. T. Tobing, "Implementation of Simple Additive Weighting on Decision Support System for Accoustic Guitar with Web-Based (Study Case: Chaniago Sport)," *Ultim. InfoSys J. Ilmu Sist. Inf.*, vol. 13, no. 2, pp. 100–109, 2022.

[13] O. Veza and N. Y. Arifin, "Sistem Pendukung Keputusan Calon Mahasiswa Non Aktif Dengan Metode Simple Additive Weighting," *J. Ind. Kreat.*, vol. 3, no. 02, pp. 71–78, 2019.

[14] P. Setiaji, "Sistem Pendukung Keputusan Dengan Metode Simple Additive Weighting," *Simetris J. Tek. Mesin, Elektro dan Ilmu Komput.*, vol. 1, no. 1, pp. 59–67, 2012.

[15] D. Darmastuti, "Implementasi metode simple additive weighting (SAW) dalam sistem informasi lowongan kerja berbasis web untuk rekomendasi pencari kerja terbaik," *JUSTIN (Jurnal Sist. Dan Teknol. Informasi)*, vol. 1, no. 2, pp. 114–119, 2013.

[16] N. Dalimunthe and C. Ismiati, "Analisis tingkat kepuasan pengguna online public access catalog (opac) dengan metode eucs (studi kasus: Perpustakaan uin suska riau)," *J. Ilm. Rekayasa dan Manaj. Sist. Inf.*, vol. 2, no. 1, pp. 71–75, 2016.

Elektronic reference:

Web

Indozone, "Penjualan laptop/pc meningkat 13% di q2 2021, hp dan lenovo mendominasi — indozone.id," 2021. [Online]. Diakses dari URL: https://www.indozone.id/tech/Aqsekbp/penjualan-laptop-pc-meningkat-13-di-q2-2021-hp-dan-lenovo-mendominasi/read-all