Development of a Web-Based Multi-Criteria Decision-Making System for Ranking Computer Brands using a Weighted Sum Model

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Abstract— In today's world of diverse computer systems being manufactured to solve various problems, numerous distinct features designed to handle specific tasks are also being introduced. This has made it progressively difficult for users and prospective buyers to correctly identify and decide on the most optimal computer to use and buy. This paper presents a web-based multi-criteria decision-making model for ranking computer brands using the Weighted Sum Model (WSM). The computer brands considered in this research work are HP, Dell, and Acer, and the hardware specifications considered are Cost, Processor, Graphics Card, RAM Capacity, Storage Capacity, Screen Resolution, Battery Life, Support/Warranty, Security Features, and Connectivity. The computer brands were evaluated based on three intended uses: Gaming, Education, and Remote work. Fifty users completed the web-based survey, and each user was required to register their account and log into the developed web-based system. The users were asked to select their preferences based on a 5-point scale. Their responses formed the basis for evaluating the criteria weights and the computer brands for their different intended uses. The results showed that the Dell model was the best gaming laptop to purchase, with a weighted sum of 0.389, followed by HP (0.329) and Acer (0.28). The best laptop for education was HP, with a weighted sum of 0.396, followed by Dell (0.297), also tied with Acer (0.297). The best for Remote Work was Acer, whose weighted sum was 0.357, followed by HP (0.336) and Dell (0.297). This research demonstrates the effectiveness of the weighted sum model in providing personalized computer brand rankings based on hardware specifications for different intended uses.

Keywords: multi-criteria decision making; weighted sum model; computer brands, hardware specifications; intended uses.

I. INTRODUCTION

Many organizations and individuals find it challenging and strenuous to acquire the right computer to support their business objectives and goals. They either purchase systems that are insufficient to perform their daily tasks or systems that are overkill, which cost the organization (both in acquisition and maintenance) more than necessary to achieve the desired objectives. Decision-making becomes more challenging in circumstances where it is grounded on multiple criteria [1].

Multi-criteria decision-making techniques can analyze multiple conflicting criteria to make a more appropriate decision [2]. There are several MCDM problems and methods classifications, but the significant difference is how a solution is obtained, which might be either implicit or explicit. The Weighted Sum Model (WSM) is an example of the MCDM method [3], whose implementation is relatively easy and very simple and can result in better decision-making [4].

MCDM methods have widely been used in analyzing multi-criteria problems. [3] Use the Weight Sum Model to rank Special Allocation Fund recipients in the Provincial Education Office of North Sumatra. The researchers established the fact that weighted sum aids better decision-making. [5] adopted the application of Entropy and TOPSIS to assist customers in deciding the best mobile phone to purchase. [6] evaluated the consumer decision-making process in selecting the best laptop. They used the Analytical Hierarchy Process (AHP) to compare each computer based on different criteria. The result showed that hardware specification was the most important criterion, followed by the core technical features factor, value-added features factor, price and payment condition, and physical appearance factor.

[7] investigated how the various computer models, having different combinations of RAM, hard disk capacity, processor type, and screen size available from different brands, meet customer requirements. Through a market survey, they analyzed five different models of desktop computers available. They selected

the best model by applying a hybrid MCDM methodology, namely the Analytic Hierarchy Process and Technique for Order of Preferences by Similarity to the Ideal Solution. [8] presented the hardware architectures of typical Internet of Things (IoT) devices and summed up many low-power techniques that make them appealing for large-scale applications. Most previous research uses questionnaires, oral interviews, market surveys, and user experiences to gather their datasets.

This research, therefore, aims to identify and rank hardware specifications and computer brands based on their intended uses, namely gaming, education, and remote work. Design a web-based multi-criteria decision-making system for ranking hardware specifications and computer brands using a weighted sum model. Implement the designed model in a web-enabled environment. This will provide baseline information to end-users and also help increase the likelihood of making good decisions about computer specifications and brands based on their intended uses.

II. RESEARCH METHODOLOGY

This research identified and assessed the relevant hardware specifications for selecting computer brands for various intended uses. The datasets used in this research were obtained from tech review sites (TechRadar, CNET, Intel, and PCMag). These review sites also provided information on the top three most popular laptop brands used in this research work as case studies. The architecture of the web-based multi-criteria decision-making system for ranking computer brands is shown in Figure 1. It consists of four modules: the user interface, the result display, the weighted sum computation, and the database. Visual Studio Code (VSC) was used as the primary development environment, and ReactJS was used to implement the front end and the result display module. The functionality of the weighted sum computation module is based on the weighted sum model, which is employed to rank the hardware criteria and computer brands in order of priority based on their intended uses. In contrast, Node.js was used to implement the back-end framework. The datasets were stored in a Microsoft Excel file, and a function was passed on node.js to retrieve the datasets from the Excel file.

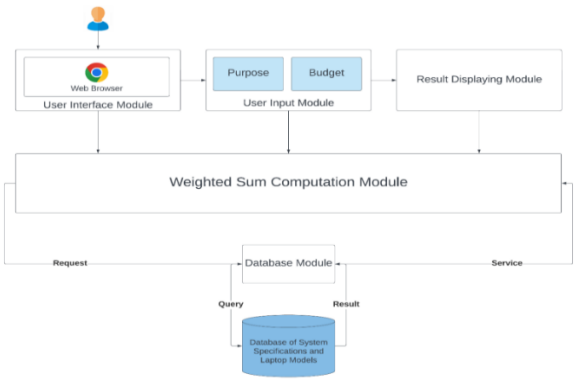

Figure 1: Web-Based Multi-Criteria Decision-Making System Architecture

A. *WEIGHTED SUM MODEL*

The weighted sum model (WSM) divides the multi-criteria decision-making problem for ranking hardware specifications and computer brands into two sub-sections. The first section explains the steps in ranking hardware specifications, and the second sub-section describes the steps in ranking computer brands.

I) Rank Criteria

The steps involved in ranking the hardware specifications are represented in Figure 2.

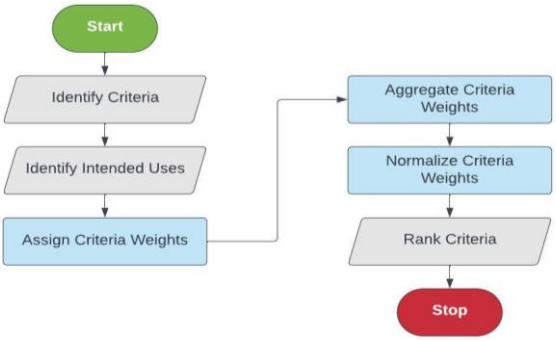

Figure 2: Flow Chart for Rating Criteria

a) Identify Criteria

The criteria considered in this research are the computer's hardware specifications. The criteria are Budget, Processor, Graphics Card, RAM Capacity, Storage Capacity, Screen Resolution, Battery Life, Support/Warranty, Security Features, and Network/Connectivity, and they are denoted C_1, C_2, C_3, …, C_{10}. Table 1 shows the criteria and their descriptions.

Table 1: Criteria and their description

Criteria C_i	Description
C_1	Budget
C_2	Processor

C_3	Graphics Card
C_4	RAM Capacity
C_5	Storage Capacity
C_6	Screen Resolution
C_7	Battery Life
C_8	Support/Warranty
C_9	Security Features
C_{10}	Network/Connectivity

b) Identify Intended Uses

This research considered three intended uses of computers, gaming, education, and remote work, as case studies for weighting the criteria.

c) Assign Criteria Weights

The performance scores obtained from the tech review sites were presented to the 50 users in this phase. They were told to provide their preferences by assigning weights to each criterion for each intended use (gaming, education, and remote work). The users assign weights to the criteria based on a 5-point scale where one represents indifferent; two represents somewhat essential, three represents important, four represents very important, and five means extremely important. Table 2 shows the criteria and their performance scores.

Table 2: Criteria and their Performance Scores

Criteria C_i	Description	Performance Scores a_{ij}				
		Indifferent	Somewhat Important	Important	Very Important	Extremely Important
		1	2	3	4	5
C_1	Budget	₦350,005 or more	₦250,005-₦350.000	₦150,005-₦250,000	₦80,005-₦150,000	₦80,000 or less
C_2	Processor	Low-end	Mid-range	Standard	High-end	State-of-the-art
C_3	Graphics Card	Low-end	Mid-range	Standard	High-end	State-of-the-art
C_4	RAM Capacity	2GB	4GB	8GB	16GB	32GB
C_5	Storage Capacity	128 GB or Less	129 GB - 255 GB	256 GB - 511 GB	512 GB - 1023 GB	1024 GB or More
C_6	Screen Resolution	720p (1280x720 pixels)	900p (1600x900 pixels)	1080p (1920x1080 pixels)	1440p or 2k (2560x1440 pixels)	4K (3840x2160 pixels)
C_7	Battery Life	5 hours or less	6 – 7 hours	7-8 hours	9-10 hours	11 hours or more
C_8	Support/Warranty	No Warranty	1-year Warranty	2-year Warranty	3-year Warranty	4 or more years of Warranty
C_9	Security Features	Not Effective	Mildly Effective	Moderately Effective	Effective	Highly Effective
C_{10}	Network/Connectivity	Low-Speed	Fair-Speed	Moderate-Speed	High-Speed	Instant-Speed

The user-assigned weights for each criterion were transformed into decision matrices using Equation (1) – (3).

Let

$$E = \{E_i\}, \forall\ i \in \{1, \ldots, n\} \quad (1)$$

where E_i denotes the users

$$C = \{C_i\}, \forall\ i \in \{1, \ldots, n\} \quad (2)$$

where C_i denotes the hardware specification.

$$D = \{D_i\} = \begin{matrix} c_1 \\ c_2 \\ \vdots \\ c_n \end{matrix} \begin{matrix} E_1 \\ \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix} \end{matrix} \begin{matrix} E_2 & \ldots & E_n \\ w_I & \ldots & w_I \\ w_2 & \ldots & w_2 \\ \vdots & \cdots & \vdots \\ w_n & \ldots & w_n \end{matrix} \quad (3)$$

where D_i denotes the decision matrix for user-assigned criteria weights and w_i denotes the criteria weights $\forall\ i \in \{1, \ldots, n\}$.

d) Aggregate Criteria Weights

After that, the decision matrices containing the user-assigned weights were aggregated for each intended use using the [8] method, as shown in Equation (4).

$$\breve{r}_i = \left(\prod_{i=1}^{n} (D_i) \right)^{1/n} \quad (4)$$

where $\breve{r}_i$ is the aggregate of decision matrices and n is the total number of users.

e) Normalize Criteria Weights

The aggregated weighted values for each intended use were normalized to a standard scale. This research adopted the normalized eigenvector, which divides the aggregated weight in each cell by its respective column total, as shown in Equation (5).

$$\alpha_i = \frac{\breve{r}_1}{B} \quad (5)$$

where α_i is the normalized eigenvector, $\breve{r}_1$ is the aggregated weights and B is the column total.

f) Rank Criteria

In this step, the hardware specifications based on their aggregated weights were ranked from highest to lowest.

II) Rank Alternatives

Figure 3 shows the steps involved in ranking computer brands.

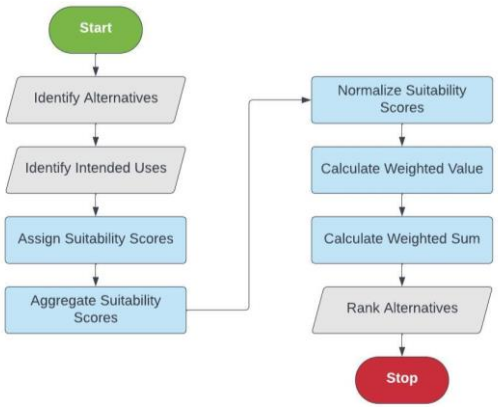

Figure 3: Flow Chart for Ranking Alternatives

a) Identify Alternatives

The computer brands considered in this research are HP, Dell, and Acer, and they are denoted by A_1, A_2, *and* A_3, as shown in Table 3.

Table 3: Alternatives.

Alternatives A_i	Description
A_1	HP
A_2	Dell
A_3	Acer

b) Identify Intended Uses

Gaming, education, and remote were the intended uses in this research.

c) Assign Suitability Scores

In this phase, each user was required to provide their suitability preferences by assigning scores to each computer brand for each intended use (gaming, education, and remote work). The users assign scores to the computer brands based on a 5-point scale: 1 is not suitable, 2 represents somewhat suitable, 3 represents suitable, 4 represents very appropriate, and 5 represents highly suitable. The user-assigned scores for alternatives were then transformed into decision matrices, as shown in Equations (6) and (7).

Let

$$A = \{A_i\}, \forall\ i\ \in \{1,\ \ldots,\ n\} \qquad (6)$$

where A_i denotes the alternatives

$$D = \{D_i\} = \begin{matrix} \\ A_1 \\ A_2 \\ \vdots \\ A_n \end{matrix} \begin{matrix} \begin{matrix} E_1 & E_2 & \ldots & E_n \end{matrix} \\ \begin{bmatrix} w_I & w_I & \ldots & w_I \\ w_2 & w_2 & \ldots & w_2 \\ \vdots & \vdots & \cdots & \vdots \\ w_n & w_n & \ldots & w_n \end{bmatrix} \end{matrix} \qquad (7)$$

whereD_i denotes the decision matrix for user-assigned weights, w_i denotes the suitability score of the Alternative A_i, and E_i denotes the users.

d) Aggregate Suitability Scores

After that, the decision matrices containing all the user-assigned suitability scores for each intended use were aggregated using the [9] method, as shown in Equation (4).

e) Normalize Suitability Scores

The aggregated suitability scores for each intended use were normalized. This research adopted the normalized eigenvector, which divides the elements in each cell by their respective column total, as shown in Equation (5).

f) Calculate Weighted Value

Equation (8) denotes the weighted value (W_i). It is calculated by multiplying the normalized criteria weights $\alpha_i\ \forall$ i {1, …, n} by the normalized suitability scores $\gamma_i\ \forall$ i ∈ {1, …, n}.

$$W_i = \alpha_i \times \gamma_i \qquad (8)$$

where α_i is the normalized criteria weight, γ_i is the normalized suitability scores, and W_i is the weighted value.

g) Calculate the Weighted Sum

The weighted sum is calculated by summing the values expressed in Equation (9).

$$A_i^{WSM-score} = \sum_{i=1}^{n} W_i \qquad (9)$$

where $A_i^{WSM-score}$ is the weighted sum, andW_i is the weighted value

h) Rank Alternatives

Each user's laptop model (alternative) is ranked from highest to lowest in this step.

III. RESULTS AND DISCUSSION

Figures 4 and 5 show that each user must register an account and log in through the user interface.

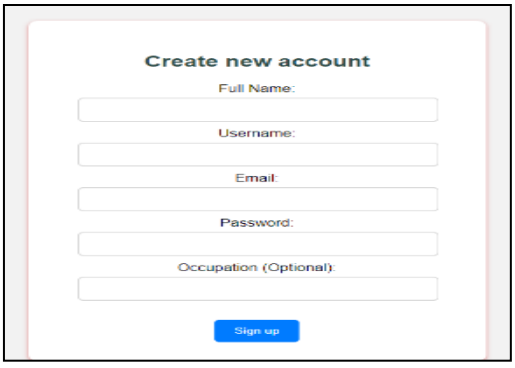

Figure 4: User Registration Page

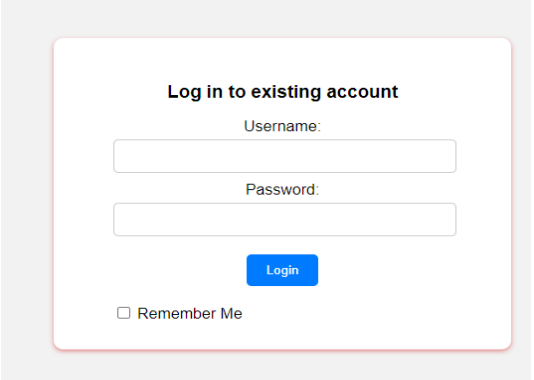

Figure 5: Login Page

Figure 6 shows the web-based platform page where users input their preferences for hardware specifications based on the 5-point scale for gaming use. In this research, 50 users evaluated the hardware specifications for each intended use.

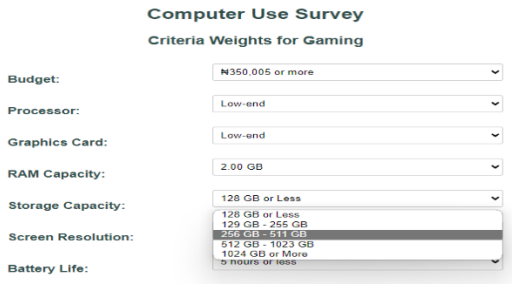

Figure 6: Criteria Weight Assignment Page

According to (c) in sub-section I, the users assigned weights to the criteria for each intended use. Tables 4-6 show the responses obtained from five users for each intended use.

Table 4: Assigned Criteria Weights for Gaming

Criteria C_j	Users E_i				
	E_1	E_2	E_3	E_4	E_5
Budget C_1	1	1	2	1	3
Processor C_2	4	3	5	5	4
Graphics Card C_3	5	5	5	5	4
RAM Capacity C_4	4	4	3	5	4
Storage Capacity C_5	3	2	4	3	5
Screen Resolution C_6	5	4	5	4	3
Battery Life C_7	2	1	2	1	1
Support/Warranty C_8	1	2	1	1	3
Security Features C_9	2	1	1	2	1
Network Connectivity C_{10}	2	3	2	3	3

Table 5: Assigned Criteria Weights for Education

Criteria C_j	Users E_i				
	E_1	E_2	E_3	E_4	E_5
Budget C_1	3	4	4	5	4
Processor C_2	2	3	2	2	4
Graphics Card C_3	2	1	2	2	2
RAM Capacity C_4	3	2	4	3	3
Storage Capacity C_5	5	3	4	3	4
Screen Resolution C_6	3	1	3	2	3
Battery Life C_7	3	3	2	2	4
Support/Warranty C_8	2	1	1	3	4
Security Features C_9	2	2	1	1	1
Network Connectivity C_{10}	2	3	4	1	2

Table 6: Assigned Criteria Weights for Remote Work

Criteria C_j	Users E_i				
	E_1	E_2	E_3	E_4	E_5
Budget C_1	2	3	2	2	4
Processor C_2	3	3	3	2	5
Graphics Card C_3	4	2	3	3	2
RAM Capacity C_4	3	4	4	5	5
Storage Capacity C_5	2	2	3	3	4
Screen Resolution C_6	3	2	2	3	2
Battery Life C_7	2	1	2	2	3
Support/Warranty C_8	2	2	1	2	2
Security Features C_9	2	3	2	2	1
Network Connectivity C_{10}	4	5	5	4	5

Table 7 shows the aggregate of user-assigned criteria weights by all 50 users for each intended.

Table 7: Aggregated Criteria Weights for Each Intended Use

Criteria C_j	$\breve{r}_t$ for Gaming	$\breve{r}_t$ for Education	$\breve{r}_t$ for Remote Work
Budget C_1	1.6	4.0	2.6
Processor C_2	4.2	2.6	3.2
Graphics Card C_3	4.8	1.8	2.8
RAM Capacity C_4	4.0	3.0	4.2
Storage Capacity C_5	3.4	3.8	2.8
Screen Resolution C_6	4.2	2.4	2.4
Battery Life C_7	1.4	2.8	2.0
Support/Warranty C_8	1.6	2.2	1.8
Security Features C_9	1.4	1.4	2.0
Network Connectivity C_{10}	2.6	2.4	4.6
Column Total B	29.2	26.4	28.4

Table 9 shows the normalized criteria weights. Calculated using the formula in Equation (5).

Table 8: Normalized Aggregated Criteria Weights for each Intended Use

Criteria C_j	α_i for Gaming	α_i for Education	α_i for Remote Work
Budget C_1	0.05	0.15	0.09
Processor C_2	0.14	0.10	0.11
Graphics Card C_3	0.16	0.07	0.10
RAM Capacity C_4	0.14	0.11	0.15
Storage Capacity C_5	0.12	0.14	0.10
Screen Resolution C_6	0.14	0.09	0.08
Battery Life C_7	0.05	0.11	0.07
Support/Warranty C_8	0.05	0.08	0.06
Security Features C_9	0.05	0.05	0.07
Network Connectivity C_{10}	0.09	0.09	0.16

The normalized weights were then used to rank the hardware specifications for each intended use, as shown in Tables 9-11.

Table 9: Ranked Specifications for Gaming

Criteria C_i	Weights	Ranking
Graphics Card	0.16	1

Processor	0.14	2
RAM Capacity	0.14	3
Screen Resolution	0.14	4
Storage Capacity	0.12	5
Network/Connectivity	0.09	6
Budget	0.05	7
Support/Warranty	0.05	8
Battery Life	0.05	9
Security Features	0.05	10

Table 10: Ranked Specifications for Education

Criteria C_i	Weights	Ranking
Budget	0.15	1
Storage Capacity	0.14	2
RAM Capacity	0.11	3
Battery Life	0.11	4
Processor	0.10	5
Screen Resolution	0.09	6
Network/Connectivity	0.09	7
Support/Warranty	0.08	8
Graphics Card	0.07	9
Security Features	0.05	10

Table 11: Ranked Specifications for Remote Work

Criteria C_i	Weights	Ranking
Network/Connectivity	0.16	1
RAM Capacity	0.15	2
Processor	0.11	3
Graphics Card	0.10	4
Storage Capacity	0.10	5
Budget	0.09	6
Screen Resolution	0.08	7
Battery Life	0.07	8
Security Features	0.07	9
Support/Warranty	0.06	10

Figure 7 shows the page where users input their suitability scores for each alternative, considering gaming as the intended use using the 5-point scale. In this research, 50 users scored the computer brands based on their suitability for use on the web-based platform.

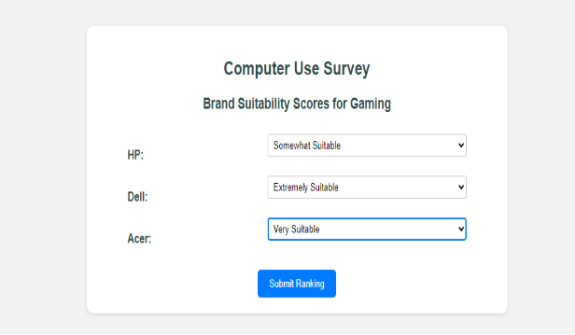

Figure 7: User Usability Page for Alternatives

Tables 12-14 show the suitability scores of five users for each intended use.

Table 12: Suitability Scores of Computer Brands for Gaming Use

Alternatives (A_i)	Decision Matrix of Performance Scores ((a_{ij})				
	Users (E_i)				
	E_1	E_2	E_3	E_4	E_5
HP (A_1)	2	3	2	3	2
Dell (A_2)	3	5	5	4	5
Acer (A_3)	2	4	3	3	4

Table 13: Suitability Scores of Computer Brands for Education Use

Alternatives (A_i)	Decision Matrix of Performance Scores (a_{ij})				
	Users (E_i)				
	E_1	E_2	E_3	E_4	E_5
HP (A_1)	5	4	3	5	4
Dell (A_2)	2	2	5	4	3
Acer (A_3)	3	4	2	3	4

Table 14: Decision Matrix of Suitability Scores of Computer Brands for Remote Work Use

Alternatives (A_i)	Decision Matrix of Performance Scores a_{ij}				
	Users (E_i)				
	E_1	E_2	E_3	E_4	E_5
HP (A_1)	5	2	3	5	4
Dell (A_2)	2	3	5	4	3
Acer (A_3)	3	5	5	3	4

Table 15 shows the aggregate suitability scores assigned by all 50 users for each intended use. The aggregation is calculated using the formula in Equation (4).

Table 15: Aggregated Suitability Scores for Each Intended Use

Alternatives (A_i)	**$\breve{r}_t$ for Gaming**	**$\breve{r}_t$ for Education**	**$\breve{r}_t$ for Remote Work**
HP (A_1)	3.8	4.2	3.8
Dell (A_2)	4.4	3.2	3.4
Acer (A_3)	3.2	3.2	4.0

Table 16 shows the normalized suitability scores computed using the formula in Equation (8).

Table 16: Normalized Aggregated Suitability Scores for each Intended Use

Alternatives (A_i)	γ_i for Gaming	γ_i for Education	γ_i for Remote Work
HP (A_1)	0.33	0.40	0.34
Dell (A_2)	0.39	0.30	0.30
Acer (A_3)	0.28	0.30	0.36

Tables 17-19 show the weighted values for gaming, education, and remote work uses. The weighted values were obtained by multiplying the normalized values of

the criteria weights in Table 9 by the normalized suitability scores in Table 16.

Table 17: Weighted Values for Gaming Use

Criteria C_i	Normalized Criteria Weights α_i	Normalized Suitability Scores γ_i			Weighted Values $W_i = \alpha_i \times \gamma_i$		
		HP	Dell	Acer			
Budget C_1	0.05	0.33	0.39	0.28	0.017	0.020	0.014
Processor C_2	0.14				0.046	0.055	0.040
Graphics Card C_3	0.16				0.053	0.062	0.045
RAM Capacity C_4	0.14				0.046	0.055	0.040
Storage Capacity C_5	0.12				0.040	0.047	0.034
Screen Resolution C_6	0.14				0.046	0.055	0.040
Battery Life C_7	0.05				0.017	0.020	0.014
Support/Warranty C_8	0.05				0.017	0.020	0.014
Security Features C_9	0.05				0.017	0.020	0.014
Connectivity C_{10}	0.09				0.030	0.035	0.025

Table 18: Weighted Values for Education Use

Criteria C_i	Normalized Criteria Weights α_i	Normalized Suitability Scores γ_i			Weighted Values $W_i = \alpha_i \times \gamma_i$		
		HP	Dell	Acer			
Budget C_1	0.15	0.40	0.30	0.30	0.060	0.045	0.045
Processor C_2	0.10				0.040	0.030	0.030
Graphics Card C_3	0.07				0.028	0.021	0.021
RAM Capacity C_4	0.11				0.044	0.033	0.033
Storage Capacity C_5	0.14				0.056	0.042	0.042
Screen Resolution C_6	0.09				0.036	0.027	0.027
Battery Life C_7	0.11				0.044	0.033	0.033
Support/Warranty C_8	0.08				0.032	0.024	0.024
Security Features C_9	0.05				0.020	0.015	0.015
Connectivity C_{10}	0.09				0.036	0.027	0.027

Table 19: Weighted Values for Remote Work Use

Criteria C_i	Normalized Criteria Weights α_i	Normalized Suitability Scores γ_i			Weighted Values $W_i = \alpha_i \times \gamma_i$		
		HP	Dell	Acer			
Budget C_1	0.09	0.34	0.30	0.36	0.031	0.027	0.032
Processor C_2	0.11				0.037	0.033	0.040
Graphics Card C_3	0.10				0.034	0.030	0.036
RAM Capacity C_4	0.15				0.051	0.045	0.054
Storage Capacity C_5	0.10				0.034	0.030	0.036
Screen Resolution C_6	0.08				0.027	0.024	0.029
Battery Life C_7	0.07				0.024	0.021	0.025
Support/Warranty C_8	0.06				0.020	0.018	0.022
Security Features C_9	0.07				0.024	0.021	0.025
Connectivity C_{10}	0.16				0.054	0.048	0.058

Tables 20-22 show the weighted sum for gaming, education, and remote work.

Table 20: Weighted Sums for Gaming Use

Alternatives Ai	Weighted Values										Weighted Sums
	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	
HP	0.017	0.046	0.053	0.046	0.040	0.046	0.017	0.017	0.017	0.030	0.329
Dell	0.020	0.055	0.062	0.055	0.047	0.055	0.020	0.020	0.020	0.035	0.389
Acer	0.014	0.040	0.045	0.040	0.034	0.040	0.014	0.014	0.014	0.025	0.28

Table 21: Weighted Sums for Education Use

Alternatives Ai	Weighted Values										Weighted Sums
	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	
HP	0.060	0.040	0.028	0.044	0.056	0.036	0.044	0.032	0.020	0.036	0.396
Dell	0.045	0.030	0.021	0.033	0.042	0.027	0.033	0.024	0.015	0.027	0.297
Acer	0.045	0.030	0.021	0.033	0.042	0.027	0.033	0.024	0.015	0.027	0.297

Table 22: Weighted Sums for Remote Work Use

Alternatives Ai	Weighted Values										Weighted Sums
	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	
HP	0.031	0.037	0.034	0.051	0.034	0.027	0.024	0.020	0.024	0.054	0.336
Dell	0.027	0.033	0.030	0.045	0.030	0.024	0.021	0.018	0.021	0.048	0.297
Acer	0.032	0.040	0.036	0.054	0.036	0.029	0.025	0.022	0.025	0.058	0.357

Finally, the weighted sums were used to rank the computer brands for the selected uses, as shown in Tables 23-25.

Table 23: Ranked Computer Brands for Gaming

Alternatives A_i	Ranked Weighted Sums	Ranking
Dell	0.389	1
HP	0.329	2
Acer	0.28	3

Table 24: Ranked Computer Brands for Education

Alternatives A_i	Ranked Weighted Sums	Ranking
HP	0.396	1
Dell	0.297	2
Acer	0.297	3

Table 25: Ranked Computer Brands for Remote Work

Alternatives A_i	Ranked Weighted Sums	Ranking
Acer	0.357	1
HP	0.336	2
Dell	0.297	3

The results show that the Dell model is the best gaming laptop to purchase after gaining a weighted sum of 0.389, followed by HP (0.329) and Acer (0.28). The best laptop for education is the HP model, whose weighted sum is 0.396, followed by Dell (0.297), which is also tied with Acer (0.297). The best for remote work is Acer, whose weighted sum is 0.357, followed by HP (0.336) and then Dell (0.297). Figures 8-10 show the web-based implementation with the same results.

Figure 8: Best Gaming Laptop.

Figure 9: Best Education Laptop.

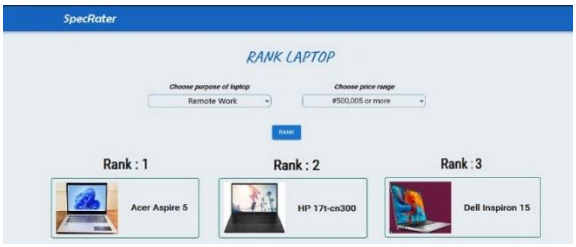

Figure 10: Best Remote Work Laptop.

The results demonstrate the effectiveness of the weighted sum model in ranking computers to meet users' unique needs. This research uses three laptop computers as case studies and evaluates and ranks their suitability across three intended uses (Gaming, Education, and Remote Work). The results realistically varied among each use and closely matched what the laptop brands represent. Dell came up top for Gaming, HP came up top for Education, and Acer ranked first for Remote Work.

IV.CONCLUSION

This research developed a web-based multi-criteria decision-making system for ranking computer brands using a weighted sum model. The study demonstrates the effectiveness of the weighted sum model in ranking computers based on individual user preferences. The findings show that the Dell model was the best gaming laptop to purchase after gaining a weighted sum of 0.389, followed by HP (0.329) and Acer (0.28). The best laptop for education was the HP model, with a weighted sum of 0.396, followed by Dell (0.297), also tied with Acer (0.297). The best for Remote Work was Acer, whose weighted sum was 0.357, followed by HP (0.336) and Dell (0.297).

Future research will endeavour to store the datasets on a dedicated database. Since the users' opinions are considered in determining our input datasets and may be potentially biased, future research intends to investigate using objective opinions to assign weight by exploring various multi-criteria decision-making techniques.

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