

# Implementation of The Topsis Algorithm in A Car Purchase Decision-Making System

Viki Julian Avinda Nur Ependi<sup>1</sup>, Dedi Gunawan<sup>2</sup>,

<sup>1,2</sup>Program Studi Teknik Informatika, Universitas Muhammadiyah Surakarta, Jawa Tengah, Indonesia  
e-mail: l200210026@student.ums.ac.id<sup>1</sup>, dedi.gunawan@ums.ac.id<sup>2</sup>

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### \*Correspondence:

l200210026@student.ums.ac.id

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## Abstract:

Private vehicles such as cars and motorcycles are crucial modes of transportation for the movement of goods and people. With technological advancements, car manufacturers offer a wide range of vehicles. Therefore, prospective buyers face challenges in selecting a vehicle that best suits their preferences and criteria. To tackle the issue, this study develops a practical decision support system (DSS) as a user-friendly tool for buyers, with theoretical contributions in the form of a more adaptive TOPSIS application and systematic analysis in car selection. This study focuses on collecting car-related data using 12 criteria, such as price, fuel consumption, safety, and design. The TOPSIS method is then normalized to ensure a fair and objective comparison between criteria. The results show the top alternative ranking, Suzuki 2002 (closeness score of 0.7089 in position 1), and the SUS test result of 85.6, indicating that the system is easy to use and capable of providing recommendations that align with user preferences. Therefore, this study highlights that the TOPSIS method can be an effective tool in supporting car purchase decision-making and making it easier for prospective buyers to choose the car that best suits their needs.

## INTRODUCTION

In this era of globalization and rapid advancement of information technology, technological developments have impacted all aspects of human life, from economics and politics to business, arts and culture, and education. Every innovation aims to make social life easier by providing various ways to carry out daily activities [1]. A business area that needs a decision-making system, such as a used car dealer. It requires an efficient decision support system to help customers navigate the vast array of specifications and prices, simplifying the complex selection process and ensuring they find a vehicle that meets their specific needs [2].

Decision Support Systems (DSS) are interactive systems that can recommend specific users using alternatives derived from data, information, and runtime model results [3]. Based

on the weighting of criteria set by management as decision-makers, this system can quantitatively display the best options. Furthermore, decisions issued by this decision support system are also known to be faster [4]. Among DSS methods, TOPSIS stands out as the most suitable and superior choice for used car selection due to its simple, efficient concept and ability to produce fast and accurate quantitative decisions [5]. Previous research by [6] on scholarship selection at SMK TI Labbaika found that the TOPSIS method was approved by SMK TI Labbaika as the method used to select scholarship recipients due to its superior results compared to SAW, with 60% accuracy for the TOPSIS method and 45% for SAW [6]. The basis of the TOPSIS method is to find the alternative that has the greatest proximity to the positive ideal solution and the furthest distance from the negative ideal solution. To measure the closeness an alternative is to the optimal solution, the Euclidean distance measurement is employed. The positive ideal solution results from combining all the best possible values for each attribute.

Meanwhile, the combination of all the worst possible values for each attribute is called the negative ideal solution [5]. The advantage is that it has a simple and efficient concept so that it can measure the performance of each alternative [7]. The final TOPSIS results will later be used as a reference for making decisions based on the recommendations offered [5]. Previous research by [5] has six criteria. The main gap in this research lies in the use of 12 comprehensive criteria (Year (C1), Engine (C2), Body (C3), Tub (C4), Chassis (C5), Tires (C6), Price (C7), Steering Comfort (C8), Interior (C9), Fuel (C10), Color (C11), and Car registration papers (C12)), which improves the accuracy of recommendations to better align with buyer needs, including crucial aspects such as often-overlooked registration documents. The implementation of TOPSIS in our DSS results in a more accurate and efficient used car selection process, as proven in similar applications in the housing sector [7].

## METHOD

The researchers utilized the SDLC Waterfall model to ensure a structured, efficient workflow, integrating the TOPSIS algorithm during the development stage to process data and generate optimized car selection decisions.

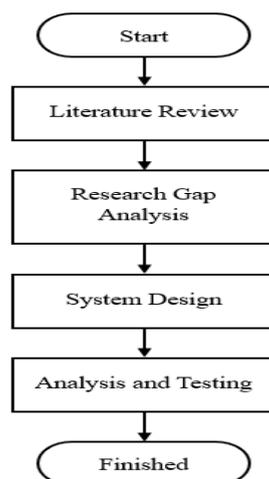


Figure 1. Research Flowchart. (Source: Author)

### 1. Literature Review

At this stage, researchers reviewed studies related to the DSS of used cars using TOPSIS, AHP, and SAW. They found gaps in the old criteria, which did not capture modern aspects such as fuel consumption, interior design, and others.

### 2. Research Gap Analysis

Looking at previous research, the research gap was identified through the limitations of 6 criteria, so that researchers can create more criteria for higher TOPSIS accuracy in used car recommendations.

### 3. System Design

The system was developed using the SDLC Waterfall model, incorporating 12 criteria derived from interviews with used car stakeholders. To generate optimal car recommendations, the TOPSIS algorithm was applied to process the decision data.

### 4. Analysis and Testing

A proper TOPSIS analysis will produce accurate rankings based on user preferences. Blackbox testing verifies the system's functionality. A System Usability Scale (SUS) is used to demonstrate the intuitiveness of the used car recommendation system.

#### 1) SDLC Waterfall

To develop the system, we adopts Waterfall method, which is a model of the system development life cycle (SDLC) containing a systematic nature from the first stage to the last stage [8]. The Waterfall method is a software development model whose processes are sequential, like a waterfall flowing downwards. In the SDLC Waterfall, each phase must be completed sequentially, and there is no change to jump to the next phase until the previous phase has been completed [9].

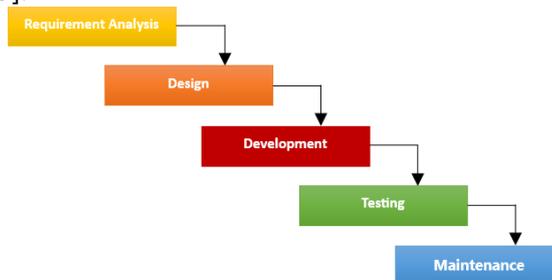


Figure 2. Waterfall Method Flow. (Source: Author)

#### 1. Requirement analysis

Analysis is the first process in website development, namely defining basic data requirements [10]. To identify the data needs of buyers in choosing a car, the author collected information by conducting observations and direct interviews with car owners.

Table 1. Functional requirements and Non-functional requirements

Functional Requirements	Non-Functional Requirements
Users access the website.	Requires stable internet access
Input 12 preference criteria	Responsive on mobile/laptop
View recommended car rankings.	Page loads in <3 seconds
Filter cars by price	SUS score $\geq 80/100$ (Excellent)

#### 2. Design

Designing a system using a flowchart is an important component of the system. Flowcharts have the advantage of being concise, time-saving, and easy to understand when explaining [11]. The TOPSIS method concludes by identifying Positive and Negative Ideal Solutions (PIS/NIS), calculating the Euclidean distance for each alternative, and generating preference coefficients to determine the final ranking of the cars.

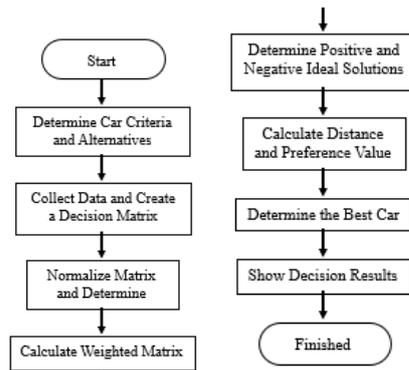


Figure 3. TOPSIS Algorithm Flowchart. (Source: Author)

### 3. Development

This stage is the implementation process of changing the system design into a program code, because the system is in the form of a website, then at this stage, it will use software and hardware [12]. The system was implemented into a web-based platform using HTML, CSS, JavaScript, and MySQL, with a specific focus on developing the TOPSIS algorithm for data processing.

### 4. Testing

After the system is completed, program testing is carried out. This is done to ensure that the system design is running as planned [13]. Testing is done using black box testing to improve software quality [14] and the system usability scale (SUS) to measure the level of usefulness or usability of a system or product based on user perception [15]. If the System Usability Scale (SUS) test succeeds in producing a high score, it proves that the system is intuitive, easy to use, and well-received by users.

### 5. Maintenance

Maintenance or care, at which stage the system operation process begins and if necessary, minor repairs are made [16]. In this way, the system remains maintained and can operate according to user needs [17]. The system maintenance focuses on updating car data and criteria weights to reflect market trends, optimizing the TOPSIS algorithm for datasets (>50 cars), and ensuring browser compatibility. These actions maintain long-term system quality and operational efficiency.

## 2) TOPSIS (Technique Order Preference by Similarity to Ideal Solution)

The TOPSIS algorithm operates on the principle of selecting the alternative with the shortest distance to the positive ideal solution while simultaneously maintaining the maximum distance from the negative ideal solution [5]. Therefore, the TOPSIS method is a decision-making process that provides a lot of information, since it takes into account the various criteria involved in a balanced way [18]. The steps for calculating the TOPSIS algorithm that will be carried out to solve a problem are as follows:

1. Determine the normalized matrix (R), using the Euclidean vector geometry length method [19].

$$R_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}}, \quad i = 1, 2, \dots, m \mid j = 1, 2, \dots, n \quad (1)$$

2. Determine the weighted normalized matrix (Y).

$$Y_{ij} = W_i R_{ij}, \quad i = 1, 2, \dots, m \mid j = 1, 2, \dots \quad (2)$$

3. Determine the positive ideal solution matrix (A+) and the negative ideal solution matrix (A).

$$A^+ = (y1^+, y2^+, y3^+, \dots, yn^+) \quad (3)$$

$$A^- = (y1^-, y2^-, y3^-, \dots, yn^-) \quad (4)$$

With:

$$y_j^+ = \begin{cases} \max_y & \text{if } j \text{ is the profit attribute} \\ \min_y & \text{if } j \text{ is the cost attribute} \end{cases} \quad (5)$$

$$y_j^- = \begin{cases} \min_y & \text{if } j \text{ is the profit attribute} \\ \max_y & \text{if } j \text{ is the cost attribute} \end{cases} \quad (6)$$

4. Calculate the distance of the alternative positive ideal (D+) and negative ideal (D-) solution matrices.

$$D_i^+ = \sqrt{\sum_{j=1}^n (y_{ij} - y_i^+)^2}, \quad i = 1, 2, \dots, m \quad (7)$$

$$D_i^- = \sqrt{\sum_{j=1}^n (y_{ij} - y_i^-)^2}, \quad i = 1, 2, \dots, m \quad (8)$$

5. Determine the preference value for each alternative (V).

$$V_i = \frac{D_i^-}{D_i^- + D_i^+}, \quad i = 1, 2, 3, \dots, m \quad (9)$$

The largest  $V_i$  value is the selected alternative.

## RESULTS AND DISCUSSION

### Requirement analysis

Based on the car data information obtained, there are 12 criteria for recommending a car, namely Year (C1), Engine (C2), Body (C3), Body (C4), Chassis (C5), Tires (C6), Price (C7), Steering Comfort (C8), Interior (C9), Fuel (C10), Color (C11), and Car Registration Documents (C12). Researchers determined both the car criteria and their corresponding weight values through interviews with sellers and buyers at used car dealers, providing the necessary data for algorithmic processing.

#### 1) Results of Determining Criteria and Weighting Values

The first stage in creating a decision support system using the TOPSIS algorithm is to determine the criteria and their weight values, which can be seen in Figure 4.

No	Criteria Code	Criteria	Value	Weight
1.	C1	Year	1980-1989	1
			1990-1999	2
			2000-2009	3
			2010-2019	4
			>2020	5
2.	C2	Engine	Emitting smoke	1
			A little bit of smoke	2
			Good	3
			Total renovation	1
3.	C3	Body	Total paint	2
			Porous	3
			Slightly painted	4
			Original paint	5
			Total paint	1
4.	C4	Tub	Porous	2
			Replaced tub	3
			Slightly painted	4
			Good	5
5.	C5	Chassis	Welded	1
			Minor improvements	2
			Intact	3
6.	C6	Tires	Thin	1
			Thick	2
			New	3
7.	C7	Price	10.000.000-15.000.000	1
			15.500.000-20.000.000	2
			20.500.000-25.000.000	3
			25.500.000-30.000.000	4
			>30.000.000	5
8.	C8	Steering Comfort	Not good	1
			Currently	2
			Good	3
9.	C9	Interior	Not good	1
			Normal	2
			Good	3
10.	C10	Fuel	Wasteful	1
			Normal	2
			Efficient	3
11.	C11	Color	Less popular (blue, red, etc.)	1
			Normal (white)	2
			Popular (black, silver, brown)	3
12.	C12	Car registration papers	Complete car documents, tax expired	1
			Complete car documents, tax applies	2

Figure 4. Criteria for selecting used cars. (Source: Author)

The criteria used to determine the weight of each alternative are shown in Table 2.

Table 2. Criteria weights

Code	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
weight	5	3	5	5	3	3	5	3	3	3	3	2

Researchers used 12 alternatives, the alternative values for each predetermined criterion can be seen in Figure 5.

No	Alternative Brands	Code	Criterion											
			C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12
1.	Mitsubishi T120ss Pickup (1991)	A1	2	3	2	1	2	2	2	2	2	3	2	1
2.	Suzuki Pickup (2003)	A2	3	3	4	4	3	2	2	2	2	3	3	1
3.	Mitsubishi L300 (1981)	A3	1	3	3	1	3	2	2	2	2	1	3	1
4.	Suzuki Potongan (2002)	A4	3	3	5	5	3	1	2	2	2	3	2	1
5.	Daihatsu Espass Pickup (2000)	A5	3	3	5	5	3	2	1	2	3	3	3	1
6.	Mitsubishi L300 (1992)	A6	2	3	2	5	3	2	3	2	2	1	1	1
7.	Suzuki Carry Pickup (1986)	A7	1	3	5	1	3	1	1	2	2	3	1	1
8.	Toyota Kijang Pickup (1983)	A8	1	3	2	4	3	1	1	2	3	1	1	1

Figure 5. Alternative Brands and Values for Each Criterion. (Source: Author)

**2) TOPSIS Algorithm Calculation Results**

Based on the data obtained, the TOPSIS method is applied through a series of systematic steps to derive the final decision results.

1. Determine the normalized decision matrix. Then produces a normalization matrix :

$$R = \begin{bmatrix} 0,324 & 0,354 & 0,189 & 0,095 & 0,244 & 0,417 & 0,378 & 0,354 & 0,309 & 0,433 & 0,324 & 0,354 \\ 0,487 & 0,354 & 0,378 & 0,381 & 0,367 & 0,417 & 0,378 & 0,354 & 0,309 & 0,433 & 0,487 & 0,354 \\ 0,162 & 0,354 & 0,283 & 0,095 & 0,367 & 0,417 & 0,378 & 0,354 & 0,309 & 0,144 & 0,487 & 0,354 \\ 0,487 & 0,354 & 0,472 & 0,477 & 0,367 & 0,209 & 0,378 & 0,354 & 0,309 & 0,433 & 0,324 & 0,354 \\ 0,487 & 0,354 & 0,472 & 0,477 & 0,367 & 0,417 & 0,189 & 0,354 & 0,463 & 0,433 & 0,487 & 0,354 \\ 0,324 & 0,354 & 0,189 & 0,477 & 0,367 & 0,417 & 0,567 & 0,354 & 0,309 & 0,144 & 0,162 & 0,354 \\ 0,162 & 0,354 & 0,472 & 0,095 & 0,367 & 0,209 & 0,189 & 0,354 & 0,309 & 0,433 & 0,162 & 0,354 \\ 0,162 & 0,354 & 0,189 & 0,381 & 0,367 & 0,209 & 0,189 & 0,354 & 0,463 & 0,144 & 0,162 & 0,354 \end{bmatrix}$$

2. Determine the weighted normalized decision matrix.

$$W = (5,3,5,5,3,3,5,3,3,3,2)$$

$$\begin{aligned} y_{11} &= W_1 r_{11} = (5)(0,324) = 1,620 \\ y_{12} &= W_2 r_{12} = (3)(0,354) = 1,062 \\ y_{13} &= W_3 r_{13} = (5)(0,189) = 0,945 \\ y_{14} &= W_4 r_{14} = (5)(0,095) = 0,475 \\ y_{15} &= W_5 r_{15} = (3)(0,244) = 0,732 \\ y_{16} &= W_6 r_{16} = (3)(0,417) = 1,251 \end{aligned}$$

Then produces a normalized weight matrix :

$$Y = \begin{bmatrix} 1,620 & 1,062 & 0,945 & 0,475 & 0,732 & 1,251 & 1,890 & 1,062 & 0,927 & 1,299 & 0,972 & 0,708 \\ 2,435 & 1,062 & 1,890 & 1,905 & 1,101 & 1,251 & 1,890 & 1,062 & 0,927 & 1,299 & 0,461 & 0,708 \\ 0,810 & 1,062 & 1,415 & 0,475 & 1,101 & 1,251 & 1,890 & 1,062 & 0,927 & 0,432 & 0,461 & 0,708 \\ 2,435 & 1,062 & 2,360 & 2,385 & 1,101 & 0,627 & 1,890 & 1,062 & 0,927 & 1,299 & 0,972 & 0,708 \\ 2,435 & 1,062 & 2,360 & 2,385 & 1,101 & 1,251 & 0,945 & 1,062 & 1,389 & 1,299 & 0,461 & 0,708 \\ 1,620 & 1,062 & 0,945 & 2,385 & 1,101 & 1,251 & 2,835 & 1,062 & 0,927 & 0,432 & 0,486 & 0,708 \\ 0,810 & 1,062 & 2,360 & 0,475 & 1,101 & 0,627 & 0,945 & 1,062 & 0,927 & 1,299 & 0,486 & 0,708 \\ 0,810 & 1,062 & 0,945 & 1,905 & 1,101 & 0,627 & 0,945 & 1,062 & 1,389 & 0,432 & 0,486 & 0,708 \end{bmatrix}$$

3. Determine the positive ideal solution and the negative ideal solution.

From the equation above, the positive ideal solution matrix can be calculated:

$$A^+ = \left\{ \begin{matrix} 2,435; 1,062; 2,360; 2,385; 1,101; 1,251; 2,835; \\ 1,062; 1,389; 1,299; 0,972; 0,708 \end{matrix} \right\}$$

And the negative ideal solution can be calculated :

$$A^- = \left\{ \begin{matrix} 0,810; 1,062; 0,945; 0,475; 0,732; 0,627; 0,945; \\ 1,062; 0,927; 0,432; 0,461; 0,708 \end{matrix} \right\}$$

4. This step involves calculating the distance of each alternative from the Positive Ideal Solution and the Negative Ideal Solution matrices based on the previously defined equations.

$$\begin{aligned} D1^+ &= 2,749 & D5^+ &= 1,958 \\ D2^+ &= 1,349 & D6^+ &= 1,967 \\ D3^+ &= 3,050 & D7^+ &= 3,271 \\ D4^+ &= 1,223 & D8^+ &= 3,134 \end{aligned}$$

And the distance between the values with the ideal solution matrix is negative:

$$\begin{aligned} D1^- &= 1,718 & D5^- &= 3,128 \\ D2^- &= 2,784 & D6^- &= 2,899 \end{aligned}$$

$$D3^- = 1,280 \quad D7^- = 1,700$$

$$D4^- = 3,214 \quad D8^- = 3,548$$

5. Determine the preference value for each alternative.

$$V_1 = \frac{1,718}{1,718+2,749} = 0,385$$

$$V_2 = \frac{2,784}{2,784+1,349} = 0,674$$

$$V_3 = \frac{1,280}{1,280+3,050} = 0,296$$

$$V_4 = \frac{3,214}{3,214+1,223} = 0,724$$

$$V_5 = \frac{3,128}{3,128+1,958} = 0,615$$

$$V_6 = \frac{2,899}{2,899+1,967} = 0,596$$

$$V_7 = \frac{1,700}{1,700+3,271} = 0,342$$

$$V_8 = \frac{3,548}{3,548+3,134} = 0,331$$

Based on the results of the preference values for each alternative, a ranking is produced as in Table 3.

Table 3. Preference Ranking Value of Each Alternative

Rank	Alternative Brands	Code	Value
1	Suzuki Potongan(2002)	A4	0,724
2	Suzuki Pickup (Tahun 2003)	A2	0,674
3	Daihatsu Espass Pickup (Tahun 2000)	A5	0,615
4	Mitsubishi L300 (Tahun 1992)	A6	0,596
5	Mitsubishi T120ss Pickup (Tahun 1991)	A1	0,385
6	Suzuki Carry Pickup (Tahun 1986)	A7	0,342
7	Toyota Kijang Pickup (Tahun 1983)	A8	0,331
8	Mitsubishi L300 (1981)	A3	0,296

### Design

In the design, there is a use case diagram which explains the relationship between the user and the system, as well as understanding the functions contained in the system and who has access to use those functions [20] and activity diagrams to describe the flow of business processes or activities that occur in a system [21].

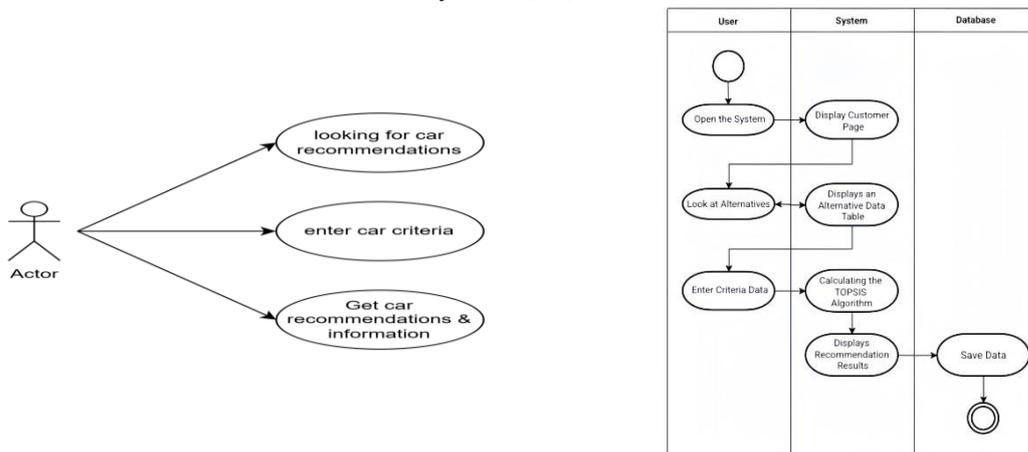


Figure 6. Use case diagram and Activity Diagram. (Source: Author)

### Development

Researchers implemented the system design into program code using HTML, CSS and JavaScript programming languages with VScode as the compiler. The results of the user interface display from the TOPSIS algorithm decision support system website to determine the best alternative can be seen below :

Figure 7 displays the selection page where users can define price criteria and choose at least two alternatives, while also presenting the TOPSIS algorithm results and final car recommendations.

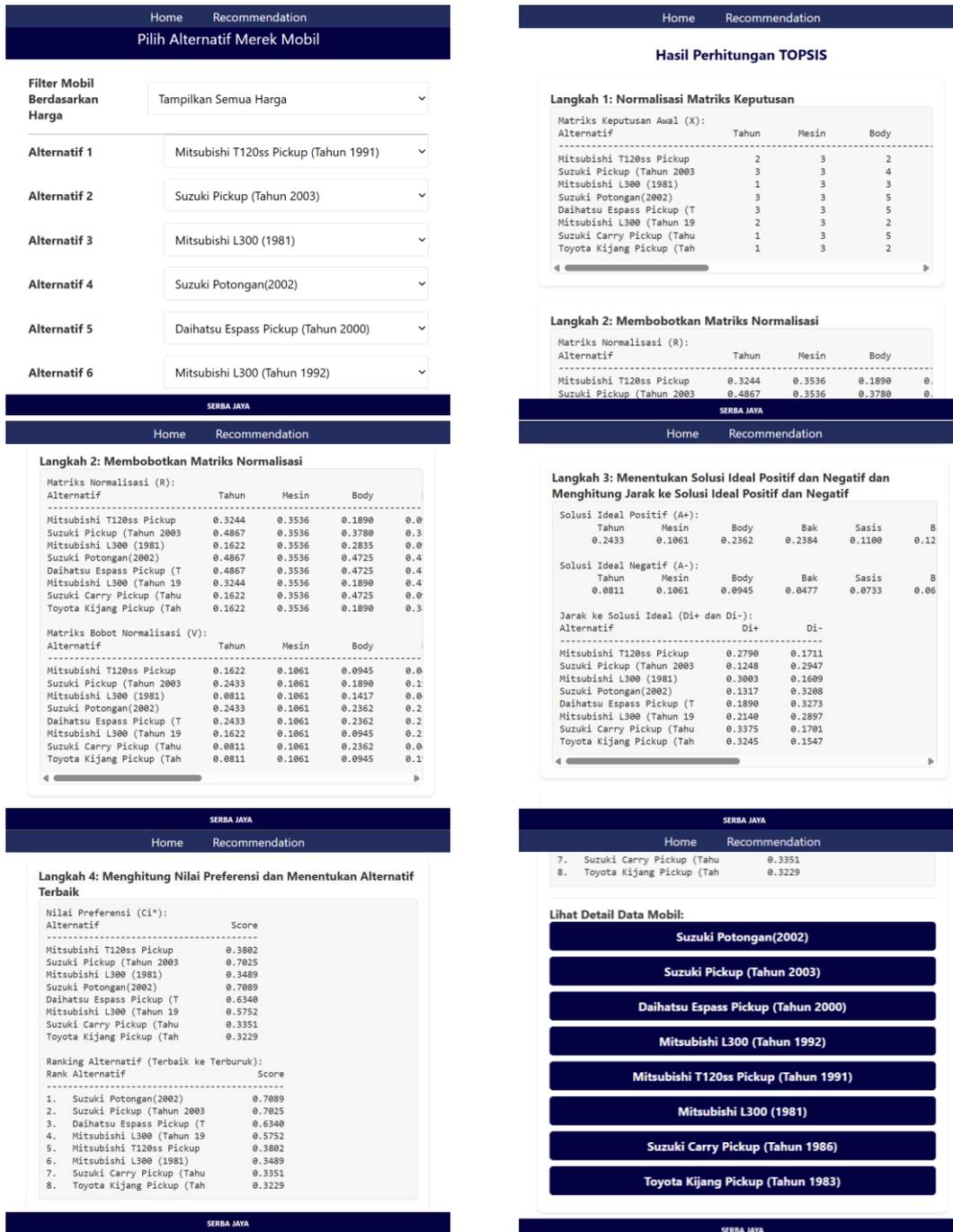


Figure 7. Website Pages. (Source: Author)

This recommendation system website presents car alternatives filtered by price, utilizing the Topsis algorithm across eight selected options. The process involves four specific stages: (1) normalizing the decision matrix, (2) applying criteria weights, (3) calculating distances to positive and negative ideal solutions, and (4) computing preference scores for final ranking. Based on these calculations, the 2002 Suzuki emerged as the top-ranked choice, with full details accessible via the system's interface.

## Testing

### 1) Blackbox Testing Results

To evaluate the developed system, researchers employed blackbox testing to identify functional errors before implementation [22], complemented by the System Usability Scale (SUS) to measure the overall level of user acceptance.

Table 4. Blackbox Test Results

No	Test Case	Test Case Description	Expected Result	Status
1	Price Filter Test	Ensure alternative pricing criteria appear in pricing options	Available alternative prices appear	Pass
		Ensure price filters work on alternative selection	Alternative options according to the price selected by the user	Pass
2	Alternative Management Test	Ensure alternative options are visible and can be entered	Alternative options may appear and be entered	Pass
3	TOPSIS Algorithm Management Test	Ensure that the inputted data matches the alternatives entered	The data entered corresponds to the alternative entered	Pass
		Ensure that the TOPSIS algorithm calculations are in accordance with each step	TOPSIS algorithm calculation according to	Pass
4	TOPSIS Algorithm Calculation Results Test	Ensure that the results of the TOPSIS algorithm calculations are relevant to user needs	The results of the TOPSIS algorithm calculations are relevant to user needs	Pass

Based on Table 4, Blackbox testing shows that the system's success rate reached 100%, which proves that the system is functioning well without errors.

**2) System Usability Scale (SUS) Results**

In the SUS test, there are ten statements for which answers have been determined, such as strongly agree, agree, neutral, disagree, and strongly disagree [22]. The SUS has a minimum score of 0 and a maximum of 100 [23].

Table 5. List of SUS Statements

No	Statement
1	I will use this website again
2	I find this website complicated to use
3	I find this website easy to use
4	I need someone else's help in using this website
5	I feel like the features of this website are working as they should
6	I feel there are many things that are inconsistent on this website
7	I feel like other people will understand how to use this website easily
8	I find this website confusing
9	I feel there are no obstacles in using this website
10	I need to get used to it first before using this website

The System Usability Scale (SUS) score is calculated by adjusting individual responses: subtracting one from odd-numbered questions and subtracting even-numbered responses from five. The sum of these adjusted scores is then multiplied by a constant of 2.5 to determine the final score [22]. Researchers have calculated the SUS scores, the results of which are shown in Figure 8.

R	SUS COUNT RESULT SCORE										Total	Value
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10		
1	3	3	3	2	3	2	4	3	2	3	28	70
2	4	2	3	3	4	4	4	3	3	1	31	77,5
3	3	2	3	3	4	4	3	4	4	3	33	82,5
4	4	4	4	4	4	4	4	4	4	0	36	90
5	4	4	4	3	4	3	4	4	4	2	36	90
6	4	4	3	4	4	4	4	4	4	3	38	95
7	4	3	4	3	4	3	4	4	4	3	36	90
8	4	4	4	4	4	4	4	4	4	4	40	100
9	4	4	4	4	4	4	4	4	4	2	38	95
10	4	4	4	4	4	4	4	4	4	4	40	100
11	4	4	4	4	4	4	4	4	3	3	38	95
12	3	3	3	2	3	3	3	3	3	2	28	70
13	4	3	4	3	4	3	2	4	4	2	33	82,5
14	3	3	4	3	4	3	3	3	3	1	30	75
15	3	3	3	3	3	3	4	4	3	4	31	77,5
16	3	3	3	1	3	3	3	3	3	3	28	70
17	4	3	3	4	4	4	4	4	4	3	37	92,5
18	3	3	4	3	3	3	3	4	3	3	32	80
19	4	4	4	4	4	4	4	4	4	0	36	90
20	4	4	4	4	4	4	4	4	0	3	35	87,5
21	3	3	3	4	3	1	4	4	3	4	32	80
22	4	4	4	4	3	4	4	4	4	4	39	97,5
23	3	3	3	3	3	2	3	3	3	3	29	72,5
24	4	3	4	3	4	4	3	4	4	2	35	87,5
25	3	4	4	4	3	4	4	4	4	3	37	92,5
<b>SUS SCORE</b>											<b>85,6</b>	

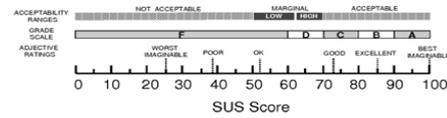


Figure 8. SUS Test Results (Source: Author) and SUS Grade Scale. [22]

A detailed SUS assessment of respondents can be seen in Figure 8. The calculation results produced a total SUS score of 85.6, which falls into the 'Acceptable' category with a B scale value. Compared to international usability standards, according to Brooke's classification, this DSS system is above the industry average (68-79). In terms of usability, this website is considered to be well accepted by users. Therefore, this study focuses on validating the final output that is directly felt by users as the main indicator of the system's success. The results of the study show a System Usability Scale (SUS) score of 85,6. The high SUS score is supported by the accuracy of the TOPSIS analysis results, thereby increasing user confidence in the system's recommendations. These results are in line with the findings in the studies "Decision Support System for Selecting the Best Housing Using the TOPSIS Method" [7] and "Determining Used Vehicles Using the TOPSIS Method" [5], which state that information from decision support systems (DSS) influences the decisions made. The TOPSIS analysis results show that the 2002 Suzuki (A4) ranks highest with a proximity score of 0.7089, meaning that this car is closest to the positive ideal solution and furthest from the negative ideal solution. This ranking is significantly influenced by the criteria of Price (C7) and Fuel (C10), which have high weights, plus Year (C1), which has a higher weight than other criteria. A 10% increase in the weight of Price (C7) actually strengthens the position of the 2002 Suzuki. Achieving a high SUS score has significant practical implications, proving that the TOPSIS-based decision support system developed is ready for implementation. Theoretically, these results reinforce the literature on Decision Support Systems (DSS) by providing empirical evidence that combining complex Multi-Criteria Decision Making (MCDM) algorithms (TOPSIS) with user-centered interface design can produce highly usable systems, as well as serve as a reference for the development of similar DSS.

## CONCLUSIONS

This study successfully developed a web-based car purchase decision support system using the TOPSIS method to provide accurate recommendations according to user needs. Testing results using the Blackbox technique showed that this system was 100% successful, meaning that the system functioned without any errors. In addition, this site was tested using the System Usability Scale (SUS) and scored 85.6 out of 100. This score indicates that the system falls into category B, with an 'Acceptable' acceptance level, meaning that the system

is easy to use and well accepted by users. For further research, it is recommended to integrate the TOPSIS-SAW hybrid method for more accurate cross-validation of rankings and to test the scalability of the system with 50+ car alternatives from various dealers.

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