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Decision Support System for Selecting Used Cars Using the Analytical Hierarchy Process (AHP) Method Based on a Website at CV Auto Mobil Manokwari

Melvi Marhaba [1,a]; Mardewi [2,b]; Yuliana Sangka [3,c]; Hasbi [4,d]; Supriyadi La Wungo [5,e,*]

[1,2,3,5] STMIK Kreatindo Manokwari, Papua Barat, Indonesia
[4] Universitas Muhammadyah Palopo, Makassar, Indonesia
[a] melvimarhaba251@gmail.com; [b] mardewi0004@gmail.com; [c] yulianasangka0@gmail.com; [d] hasbi@umpalopo.ac.id; [e] supriyadi.la.wungo@gmail.com;
** Corresponding author*

Abstract

Buying a used car is often considered by the public as an alternative because it is more affordable than a new one. However, the process of choosing a used car is not easy because there are various factors that must be considered, such as engine condition, completeness of documents, physical condition, price, engine capacity, and year of manufacture. At CV Auto Mobil Manokwari, prospective buyers often have difficulty determining the choice of a used car that best suits their needs and budget. This research aims to design a website-based decision support system using the Analytical Hierarchy Process (AHP) method to assist buyers in choosing used cars objectively and systematically. The AHP method is used to compare each criterion in pairs and determine the priority weight of each criterion. The system was developed using the PHP programming language and MySQL database with a waterfall approach. With this system, the process of selecting used cars becomes more directed, accurate, and efficient, as well as helping users make decisions practically and quickly, and objectively.

Keywords*—Decision Support System, Analytical Hierarchy Process, Car Rental, AHP Weighting, Mobil Bekas.*

1. Introduction

The selection of used cars is often considered by the public due to their more affordable prices compared to new cars. However, choosing a used car is not an easy task, as there are various factors to consider beyond affordability, such as vehicle condition, document completeness, year of manufacture, and other factors (R. Saputra & Batusangkar, 2023). Therefore, the use of a Decision Support System (DSS) in selecting used cars can help prospective buyers make more systematic and objective decisions by taking into account various important factors (Guvinda, 2024).

In the first study titled "Used Car Selection System Using Analytical Hierarchy Process (AHP) Method (Case Study at Gemilang Mobil Showroom)" (A. R. Saputra & Kusuma, 2020), the Analytical Hierarchy Process (AHP) method was applied to determine the best used car based on criteria comparisons and priority weights. The results showed that the developed system was able to provide structured and objective vehicle recommendations, with the highest-rated vehicle becoming the main choice.

The second study titled "Decision Support System for Used Car Selection Using the Analytical Hierarchy Process Method" (Gushelmi & Guswandi, 2021) used the Analytical Hierarchy Process (AHP) method to develop a decision support system for selecting used cars, aiming to make the decision-making process faster and more accurate. The system was developed using PHP programming language to make data processing more efficient and easier for users in choosing used cars. Additionally, the system used a MySQL database to ensure that the data was well-stored and secure. The results showed that the developed system facilitated users in selecting used cars based on the ranking produced.

The third study titled "Web-Based Decision Support System for Used Car Selection Using AHP (Analytical Hierarchy Process) Method" (Santosa et al., 2022) developed a web-based decision support system to assist the used car selection process using the AHP method. The system included users as prospective buyers and Eagle Motor showroom as the admin. The results showed that the system had been tested and worked well, enabling more effective decision-making in selecting used cars.

The fourth study titled "Decision Support System for Used Car Selection Using Analytical Hierarchy Process Method at CV. Icha Mobilindo" (Widyastuti & Roestam, 2022) focused on designing a decision support system using the Analytical Hierarchy Process (AHP) to support the used car selection process at CV. Icha Mobilindo. The results showed that the system design was capable of presenting a list of used cars in a structured manner based on the ranking of alternatives calculated using the AHP method. Although the system was still in the design stage, it was expected to assist customers in choosing vehicles that suited their needs and to provide a foundation for system development that supports improved service in vehicle selection.

The fifth study titled "Decision Support System for Car Purchase Using AHP Method at Bintang Motor Muara Bungo" (Praptomo & Jasmir, 2023) discussed the development of a decision support system for vehicle selection at Bintang Motor Muara Bungo using the Analytical Hierarchy Process (AHP) method. Currently, the vehicle selection process is still conducted manually, making it difficult for consumers to determine their choice. The system was designed to help make more systematic considerations in vehicle selection based on specific criteria. The results showed that the developed system represented the ranking of used car alternatives using the AHP method, although it was still in the conceptual stage and had not yet been implemented in a real system. Therefore, at this stage, the results were only conceptual and could serve as a foundation for further system development to support the vehicle selection decision-making process.

CV Auto Mobil Manokwari, located on Drs. Esau Sesa Street, Sowi, Manokwari Regency, West Papua Province, offers a variety of used cars at different prices according to the needs and budgets of buyers. Although many used car options are available, prospective buyers often face challenges in choosing the right car. In selecting the ideal used car, several factors must be considered, such as engine condition, document completeness, physical condition, price, engine capacity, and year of manufacture. These factors need to be evaluated systematically to ensure that the decision made is accurate and optimal.

To address this problem, a system is needed that can assist prospective buyers in making objective, systematic, and efficient decisions. A website-based decision support system (DSS) using the Analytical Hierarchy Process (AHP) method is an appropriate solution. The AHP method allows for pairwise comparisons of important criteria and calculates their relative importance weights, thereby providing optimal used car recommendations based on a comprehensive analysis of vehicle conditions. With this system, prospective buyers will be facilitated in selecting quality used cars without having to conduct manual evaluations, which are time-consuming and prone to errors. The system will display car recommendations with the highest rankings based on AHP analysis, making the selection process more practical, quick, and objective.

Based on the above problem, it is necessary to develop a "website-based decision support system for used car selection using the Analytical Hierarchy Process (AHP) method" to assist prospective buyers in selecting used cars according to predetermined criteria, thereby simplifying the used car selection process at CV Auto Mobil Manokwari.

2. Method

2.1 Research Location and Time

This research was conducted at CV Auto Mobil Manokwari, located on Drs. Esau Sesa Street, Sowi II, Manokwari Regency, West Papua Province. The research was carried out from March to May 2025.

2.2 Analysis of the Analytical Hierarchy Process (AHP) Method

The method used in the design of the Decision Support System for Used Car Selection is the **Analytical Hierarchy Process (AHP)**, a method used to rank various alternatives and choose the best option based on the weights of predetermined criteria (Suprapto, 2022). In this method, the criteria are compared with each other to obtain priority weights. Each alternative is then evaluated based on the established criteria (Sitinjak & Silalahi, 2023). There are several stages involved in solving problems using the Analytical Hierarchy Process (AHP) method (Hermawan & Diana, 2021).

2.2.1 Hierarchy

The Analytical Hierarchy Process (AHP) method begins by constructing a decision hierarchy, as illustrated in Figure 1, to provide a clearer understanding of the relationships between the goal, criteria, and the alternatives being considered.

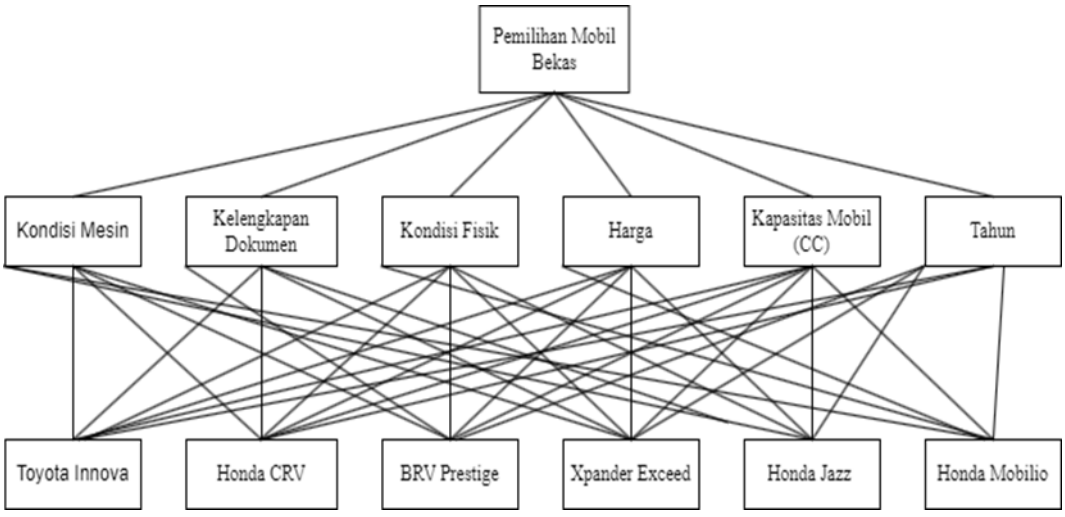

Figure 1. Hierarchy of Used Car Selection

2.2.2 Determination of Criteria and Sub-Criteria in the Analytical Hierarchy Process Method

In this decision support system, several criteria and sub-criteria are used as a reference in the decision-making process. The criteria and sub-criteria can be seen in Table 1 below.

Table 1. Criteria and Sub-Criteria Data for Used Car Selection

Criteria Name	Sub-Criteria
Engine Condition	Very Good, Good, Fair
Document Completeness	Complete, BPKB without STNK, STNK without BPKB, No BPKB and STNK
Physical Condition	Very Good, Good, Fair
Car Price	150–200 million IDR, 201–250 million IDR, 251–300 million IDR, >300 million IDR
Engine Capacity	2,100–2,400 CC, 1,600–2,000 CC, 1,000–1,500 CC
Year of Manufacture	2015–2018, 2019–2022, 2023
Engine Condition	Very Good, Good, Fair

2.2.3 Alternatives in the Analytical Hierarchy Process Method

Alternatives are the data selected by the decision-maker. In this case, there are six cars that serve as alternatives for used car selection. The alternative data can be seen in Table 2 below.

Table 2. Alternative Data

No	Car Name
1	Toyota Innova
2	Honda CRV
3	BRV PRESTIGE
4	XPANDER EXCEED
5	Honda Jazz
6	Honda Mobilio

2.2.4 Criteria and Sub-Criteria Values

After the decision hierarchy is created, the next step is to assign comparison values for each criterion and sub-criterion. This is done by comparing the criteria and sub-criteria in pairs within a comparison matrix using a 1–9 scale, as described in Table 3 below.

Table 3. Comparison Scale Values

Intensity of Importance	Description
1	Both elements are equally important.
3	One element is slightly more important than the other.
5	One element is more important than the other.
7	One element is clearly more strongly important than the other.
9	One element is absolutely more important than the other.
2, 4, 6, 8	Intermediate values between the two adjacent judgments.
Reciprocal	If activity i is assigned a certain value when compared to activity j, then *j* has the reciprocal value when compared to *i*.

2.2.5 Synthesis of priority

For each criterion and each sub-criterion, priorities are determined through pairwise comparisons, where each element is compared based on its level of importance relative to the others. These comparison values are adjusted according to the given judgments to obtain accurate weights and priorities.

2.2.6 Logical Consistency

In decision-making, it is important to ensure a good level of consistency because the resulting decisions should not be based on inconsistent reasoning. The consistency measurement process is carried out through the following steps:

1. Calculate the eigenvalue (λmax) by multiplying each value in the total of the comparison column with the relative priority of the first element, the value in the second column with the relative priority of the second element, and so on.

2. Calculate the Consistency Index (CI) using the following formula:

   CI = (λ maks - n) / (n-1)
   where
   CI : Consistency Index.
   λ max : The maximum eigenvalue of the pairwise comparison matrix.
   n : The number of criteria or elements in the matrix.
   If the Consistency Index (CI) approaches 0, then the pairwise comparison matrix has a high level of consistency.
3. Calculate the Consistency Ratio (CR) using the following formula:
   CR = CI/IR
   where
   CR : Consistency Index.
   IR : Indeks Random Concictency
   The Random Consistency Index can be seen in Table 4 below.

Table 4. List of Random Index Values

Matrix Size	RI Value
1,2	0,00
3	0,58
4	0,90
5	1,12
6	1,24
7	1,32
8	1,41
9	1,45
10	1,49
11	1,51

3 Results And Discussion

This study aims to support decision-making in selecting the optimal used car at *Auto Mobil Manokwari* using the Analytical Hierarchy Process (AHP) method. The evaluation is based on six main criteria: Engine Condition, Document Completeness, Physical Condition, Price, Engine Capacity (CC), and Year of Manufacture. Each criterion was analyzed thoroughly through pairwise comparisons and subcriteria weighting.

3.1. Criteria Priority Calculation

Based on the pairwise comparison matrix and normalization process, the priority weights of each criterion were determined, as shown in Table 5.

These results indicate that engine condition is the most important factor in decision-making, followed by document completeness and physical condition.

Table 5. Criteria Priority Weights

Criteria	Priority Weight
Engine Condition	0.385
Document Completeness	0.248
Physical Condition	0.158
Price	0.102
Engine Capacity (CC)	0.065
Year of Manufacture	0.043

3.2. Consistency of the Pairwise Matrix

To validate the consistency of the pairwise comparisons, the consistency ratio (CR) was calculated. The resulting CR value is 0.027 or 2.7%, which is below the acceptable threshold of 10%, indicating that the matrix is consistent and suitable for decision-making.

3.3. Subcriteria Priority Calculation

For criteria with subcriteria, such as engine condition and physical condition, priority weights were also calculated. An example of the subcriteria weights for engine condition is shown in Table 6.

Table 6. Engine Condition Subcriteria Weights

Subcriteria	Weight
Very Good	0.540
Good	0.297
Fair	0.163

Subcriteria for other factors—such as document completeness, price range, engine capacity, and production year—were also weighted based on AHP analysis, reflecting buyer preferences.

4. Evaluation of Used Car Alternatives

Six used car alternatives were analyzed by multiplying their subcriteria values by the corresponding criteria weights. The final scores for each alternative are shown in Table 7.

Table 7. Final Scores of Used Car Alternatives

Alternative	Final Score
BRV Prestige	0.4247
Honda Mobilio	0.3699
Xpander Exceed	0.3595
Toyota Innova	0.3429
Honda CRV	0.3184
Honda Jazz	0.2943

According to the results, **BRV Prestige** ranks first as the best used car alternative with the highest final score, followed by **Honda Mobilio** and **Xpander Exceed**.

3.4. Implementation

a. Criteria Page

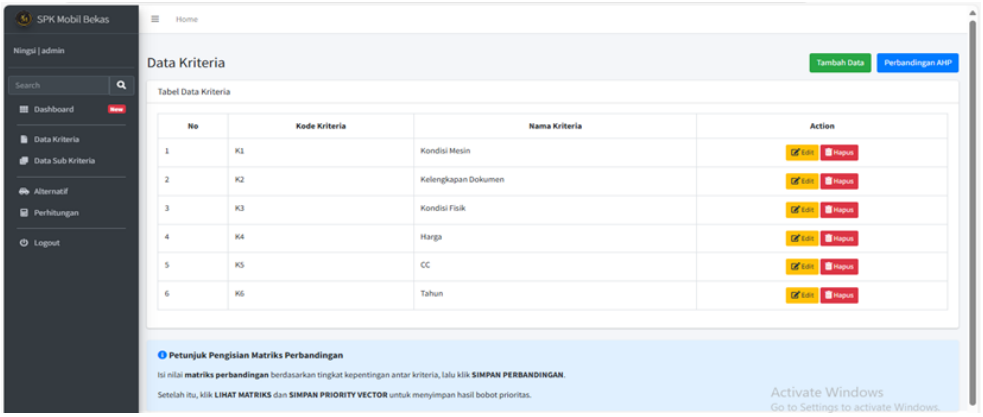

Figure 2. Criteria Page

The Criteria Page contains a list of criteria used as the basis for evaluation in the used car selection process. On this page, the administrator can add, edit, and delete criteria data, as well as perform AHP (Analytic Hierarchy Process) calculations to determine the weights or priority of each criterion. This page facilitates the administrator in managing the criteria data that supports the decision-making system. The interface of the Criteria Page is shown in Figure 1 below.

b. Subcriteria Page

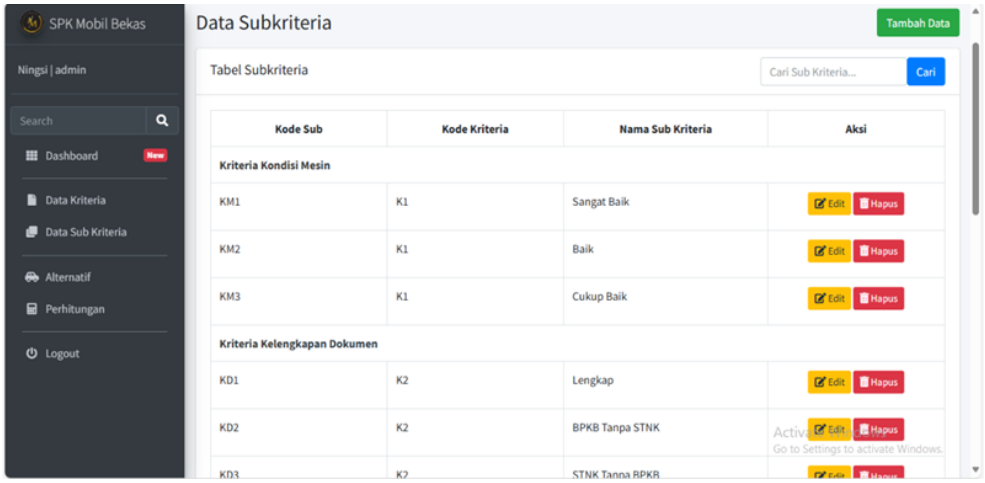

Figure 3. Subcriteria Page

The **Subcriteria Page** contains a list of subcriteria used as the basis for evaluation in the used car selection process. On this page, the administrator can add, edit, and delete subcriteria data, as well as perform AHP (Analytic Hierarchy Process) calculations to determine the weights or priorities of each subcriterion. This page facilitates the administrator in managing subcriteria data that supports the decision-making system. The interface of the Subcriteria Page is shown in **Figure 3** above.

c. Alternative Page

The **Alternative Page** displays a list of used cars that are evaluated in the decision-making process using the decision support system. On this page, the administrator can manage the car data, including adding new alternatives, updating existing car information, and deleting records as needed.

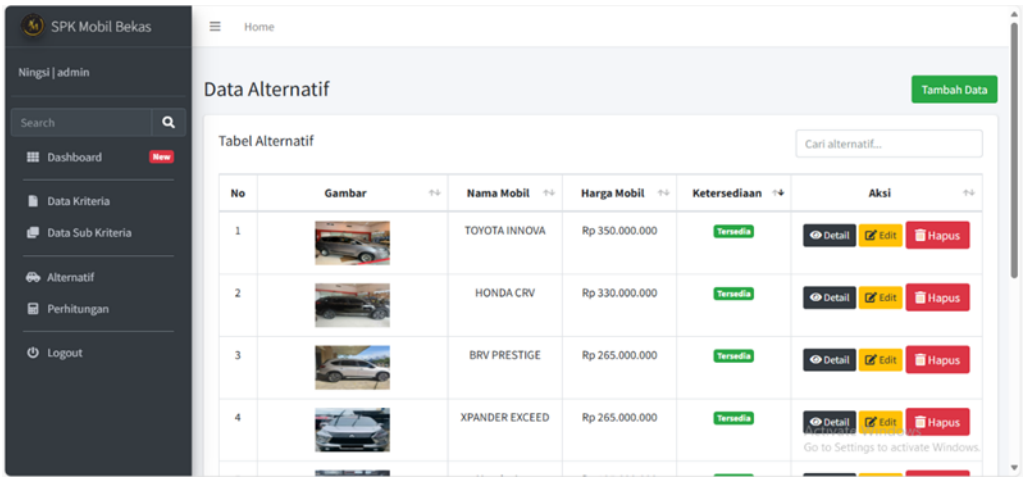

Figure 4. Alternative Page

d. Calculation Page

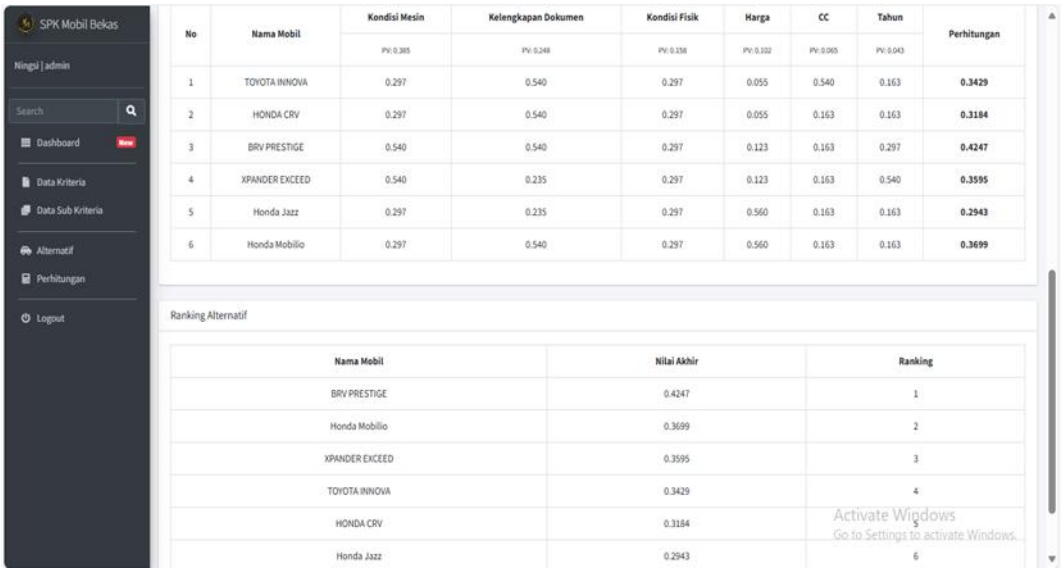

Figure 5. Calculation Page

The **Calculation Result Page** displays the final outcome of the used car selection process. On this page, the administrator can view the calculation results in the form of a ranking of vehicles, based on the evaluation using the predefined criteria and subcriteria. A representation of this page is shown in **Figure 5** above.

e. Alternative Selection Page

On the **Alternative Selection Page**, users can view a list of available used cars along with key information such as the car name, year of manufacture, and price. Each car entry includes a **"View Details"** button that allows users to access more comprehensive information about the selected vehicle. To make a selection, users can check the **"Select"** box next to each car they wish to consider. Once the selection is complete, users can click the **"Proceed to Calculation"** button to continue to the recommendation results based on the Analytical Hierarchy Process (AHP) computation. This page enhances the interactivity of the decision support system by

allowing users to actively participate in filtering and evaluating alternatives before the final recommendation is displayed.

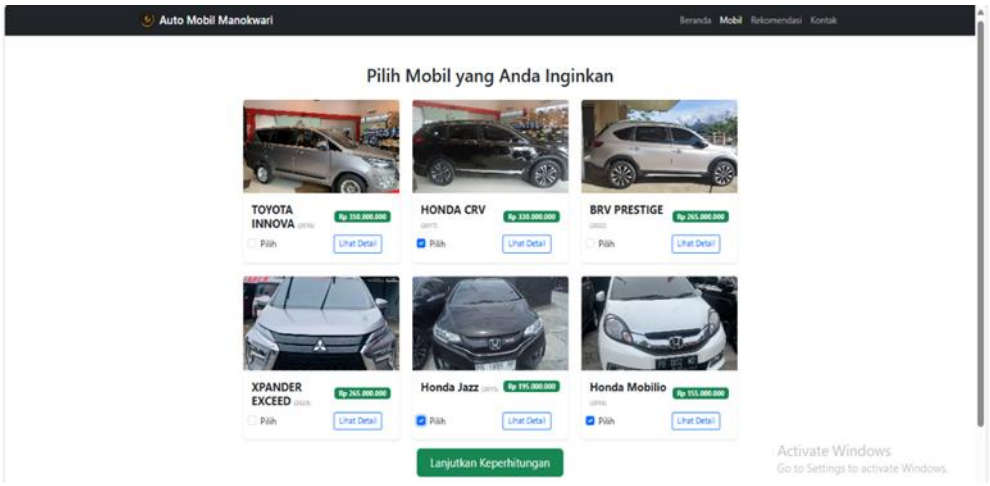

Figure 8. Alternative Selection Page

f. Recommendation Result Page

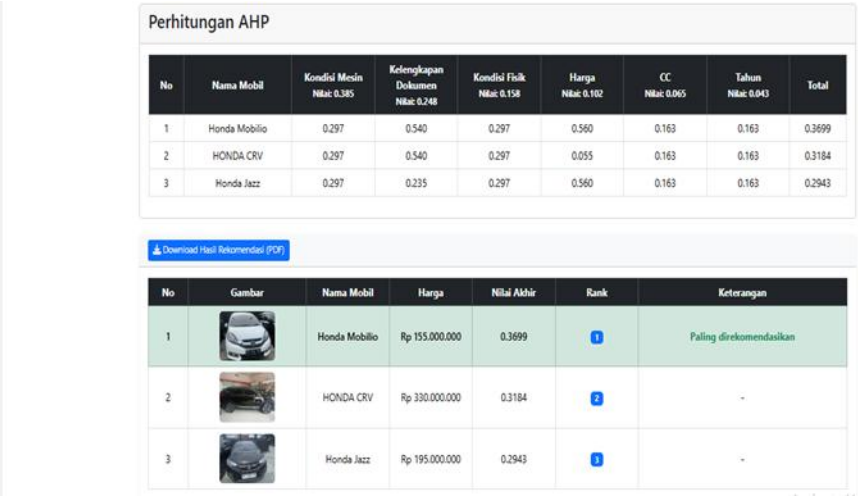

Figure 9. Halaman Perhitungan.

On the Recommendation Result Page, the system displays the calculation results and rankings based on the cars previously selected on the Alternative Selection Page. Each selected car is evaluated using the AHP (Analytical Hierarchy Process) method to determine which vehicle best meets the predefined criteria. The recommendation results are presented in a table format, which includes the car name, price, final score, ranking, and remarks. This allows users to clearly identify the most suitable car, as the system highlights the one with the highest ranking based on the AHP computation. Through this page, users can make well-informed decisions, supported by a structured and transparent recommendation process.

3 Conclusions

Based on the results of the research and the previous discussions, it can be concluded that the web-based decision support system for selecting used cars using the Analytic Hierarchy Process (AHP) method has been successfully developed to assist prospective buyers at CV Auto Mobil

Manokwari. The system is capable of processing predefined criteria and subcriteria, performing ranking calculations using the AHP method, and displaying recommended used cars that best match the user's needs. With the implementation of this system, the used car selection process becomes more structured, faster, and more objective, thereby facilitating better decision-making for potential buyers.

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