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Implementation of a Web-Based Decision Support System for the Selection and Recommendation of Sales Helper Actions

Chairul Habibi[1), Fauzan Kurnia T P[2), Sardjono[3)
[1) Information System, Faculty of Technology and Informatics, Indonesian University of Informatics and Business
[2) Informatics, Faculty of Technology and Informatics, Indonesian University of Informatics and Business
[3) Informatics, Faculty of Technology and Informatics, Indonesian University of Informatics and Business
Email: habibi.crl@gmail.com; fauzan_KP@gmail.com; srdj.ono@gmail.com.

Abstract

The credit simulation process performed by sales personnel and the decision-making process for vehicle credit approval by sales supervisors are frequently conducted in an ineffective and inefficient manner. This situation is commonly found in large-scale companies where sales personnel and sales supervisors play a critical role in Toyota vehicle sales operations. Several issues have been identified, including a time-consuming and inefficient credit simulation process, as well as a credit application decision-making process that relies heavily on manual evaluation. Consequently, an integrated system is required to address these challenges. This study proposes the development of a web-based system capable of conducting vehicle credit simulations and supporting credit approval decisions using the Simple Additive Weighting (SAW) method. The web-based implementation allows users to access the system easily through web browsers on various electronic devices connected to the internet.

Keywords: Sales, Sales Supervisor, Dealer, Simple Additive Weighting, Web.

1 INTRODUCTION

An application can be defined as a software program that runs on a computer system and is designed to assist humans in performing various activities and completing specific tasks (Suhimarita & Susianto, 2019). In the current digital era, the use of applications has become a fundamental necessity to improve the efficiency and effectiveness of daily human activities. One widely adopted approach in application development is the use of web technology as the primary platform. This is because web-based applications offer several advantages, including ease of access, centralized maintenance, and installation processes that are performed only on the server side (Pressman, 2015).

Along with the increasing demand for applications as tools to support routine human activities, the number and variety of developed applications have also continued to grow in accordance with user needs. One type of application that has been extensively developed is the application that implements a Decision Support System (DSS). A decision support system is designed to assist decision makers by utilizing data, models, and knowledge derived from experts, thereby enabling more objective and measurable decision-making processes (Turban et al., 2011).

The development of applications and their functionalities has also had a significant impact on vehicle purchasing activities, particularly in the automotive sector. The intensifying competition within the automotive industry has encouraged car dealers to continuously improve the quality of their services to prospective buyers. Customers increasingly demand fast and accurate access to information related to vehicle prices, payment schemes, and credit facilities. This situation has led to intense competition among car dealers to attract potential buyers through effective marketing strategies and fast yet efficient services, with the ultimate goal of achieving customer satisfaction.

In implementing these marketing strategies, automotive companies require competent human resources, especially sales personnel who operate under the coordination of a sales supervisor. Sales personnel play a primary role in providing explanations regarding vehicle products, pricing information for both cash and credit purchases, requirements for vehicle credit applications, and assistance throughout the credit application process to financing institutions. In addition, sales personnel are responsible for providing credit installment simulations that inform prospective buyers of the monthly payments based on the specified down payment amount.

However, in practice, several obstacles arise in conducting vehicle credit simulations. Credit simulations are still performed using Microsoft Excel-based applications stored on branch office computers. Consequently, sales personnel who are outside the office must contact the sales supervisor to conduct credit simulations, making the process less flexible and relatively time-consuming. This issue becomes more complex when changes in down payment amounts occur, as the simulation process must be repeated from the beginning.

Several web-based credit simulation platforms have been utilized by sales personnel; however, these platforms are generally provided by only a limited number of financing institutions. Meanwhile, dealers often collaborate with multiple vehicle financing service providers. As a result, sales personnel must switch between different platforms or perform manual calculations to accommodate the varying credit schemes offered by each provider. This condition potentially reduces work efficiency and the quality of service delivered to prospective buyers.

On the other hand, sales supervisors, who are responsible for overseeing sales personnel, also face challenges in analyzing vehicle credit applications. The analysis process is still conducted manually by considering various applicant documents, such as income statements, residential status, bank statements, routine expenditures, and existing installment obligations. This manual process increases the risk of subjectivity and inconsistency in decision making. Therefore, a decision support system is required to assist sales supervisors in determining the eligibility of credit applications in an objective and systematic manner (Hendrian & Himawan, 2021).

Based on these issues, this study aims to develop a web-based application that assists sales personnel in performing vehicle credit simulations by adjusting the down payment amount to the corresponding monthly installment values across multiple financing service providers. Furthermore, this study seeks to develop a decision support system that supports sales supervisors in approving or recommending vehicle credit applications in a faster, more accurate, and more consistent manner, as demonstrated in previous studies on decision support systems for vehicle credit assessment (Permana et al., 2022).

2 LITERATURE REVIEW

The fundamental concept of the **Simple Additive Weighting (SAW)** method is to determine the **weighted sum of performance ratings for each alternative across all attributes**, where the attribute values are first normalized to ensure proportional comparability among criteria. The SAW method is widely applied in **multi-criteria decision-making systems**, particularly within the framework of **multi-attribute decision making (MADM)**, to address problems involving the **selection and ranking of alternatives**. Consequently, SAW is well suited for application in various alternative selection scenarios within **decision support systems**. Recent studies have demonstrated the applicability of SAW across diverse selection contexts due to its ability to **aggregate attribute weights and performance scores in a single, computationally simple yet effective calculation (Nanda et al., 2023)**.

The formula used to perform the normalization is:

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$$r_{ij} = \begin{cases} \dfrac{X_{ij}}{\text{Max}_{ij}^{x}}, \text{If j is Benefit item} \\ \dfrac{\text{Min}_{ij}^{x}}{X_{ij}}, \text{If j is cost item} \end{cases} \tag{1}$$

Where r_{ij} is the normalized performance rating of alternative Ai on attribute C_j: i = 1,2…,m and j = 1,2…,n

Description :

Max X_{ij} = The largest value of each criterion i.
Min X_{ij} = The largest value of each criterion i.
X_{ij} = The attribute value of each criterion.
Benefit = The largest value is the best.
Cost = The smallest value is the best.

The preference value for each alternative (Vi) is given by the following formula.

$$Vi = \sum_{J=1}^{n} w_j r_{ij} \tag{2}$$

Description:

Vi = Ranking for each alternative.
wj = Ranking weight value (for each criterion).
rij = Normalized performance rating value

The determination of indicators used as inputs for value weighting constitutes the initial step in the application of the *Simple Additive Weighting (SAW)* method as a *multi-criteria decision-making* approach within a decision support system. The SAW method is widely applied in credit or loan eligibility assessments due to its ability to aggregate weighted criteria values into a final score that allows comparison among alternatives. In the context of credit applicant evaluation, several studies have implemented the *5C* criteria—Character, Capacity, Capital, Collateral, and Condition of Economy—as the primary basis for assessment in SAW-based decision support systems. For instance, research on decision support systems for mortgage loan eligibility indicates that the 5C criteria are essential determinants in assessing creditworthiness (Nanda et al., 2023).

1. Character
   This criterion is used to assess the character of prospective borrowers, including their financial behavior, reliability, and loyalty within their social and financial environment. Character is a fundamental component of the 5C principle and plays a crucial role in predicting the likelihood that a borrower will fulfill credit obligations (Nanda et al., 2023).
2. Capacity
   Capacity refers to the borrower's actual ability to repay the loan, as measured by income level and overall financial capability. In many SAW-based credit evaluation studies, capacity is treated as a key indicator for determining whether applicants are able to meet installment payment requirements (Nanda et al., 2023).
3. Capital
   The capital criterion reflects the assets or financial resources owned by the credit applicant, which indicate financial strength and stability in supporting loan repayment. Capital is

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frequently incorporated as an evaluation indicator in SAW calculations for credit eligibility (Tanto, 2023).

4. Collateral
Collateral refers to physical or financial assets pledged by the borrower that may be seized by the lending institution in the event of default. Studies on SAW-based credit decision support systems emphasize that the quality and value of collateral are critical factors in determining loan eligibility (Tanto, 2023).
5. Condition of Economy
The condition of economy criterion represents the economic environment and financial management conditions affecting the borrower, including household financial stability. This criterion is used to evaluate external and internal economic factors that may influence the borrower's ability to repay the loan (Tanto, 2023).

The SAW method processes the values of each criterion through normalization and weighted summation to generate a final ranking score for each credit applicant. Applicants with the highest scores are then identified as the most eligible candidates for credit approval based on multi-criteria decision-making principles (Nanda et al., 2023).

3 RESEARCH METHODS

This study employs a qualitative research approach, where data are collected through structured observations and in-depth interviews with sales personnel and sales supervisors. The resulting qualitative data are systematically analyzed to elicit decision criteria and requirements that form the basis for the design and development of the application. The analytical mechanism implemented in the system is the Simple Additive Weighting (SAW) method, which is used to perform multi-criteria evaluation and ranking of alternatives.

Following system implementation, an evaluation phase is conducted to assess the alignment between the decision outcomes generated by the SAW-based application and the expectations of sales personnel and sales supervisors, thereby determining the effectiveness of the system in supporting managerial decision-making processes.

4 RESULT AND DISCUSSION

This section presents the research findings obtained from the conducted study.

4.1 Simulation Techniques

4.1.1 Simulation Corporate

The process of calculating vehicle credit installment simulations is based on vehicle data and leasing data stored in the database. These data are then calculated by incorporating the down payment and the installment period proposed by the customer. The calculation logic for the vehicle installment simulation is as follows.

$$\textit{Installment Amount} = \frac{P + (P \times r) - D}{n}$$

P = *Vehicle Purchase Price*

r = *Leasing Interest Rate*

D = *Down Payment*

n = *Installment Duration (number of periods)*

Figure 1. Installment Amount

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As an example, consider a vehicle priced at IDR 298,000,000 with an interest rate of 13.8%. The customer plans to make a down payment of IDR 89,400,000, with an installment period of three years (36 months). The calculation is performed as follows.

$$\text{Install. A} = \frac{\big(298.000.000 + (298.000.000 \times 13{,}8\%)\big) - 89.400.000}{36}$$
$$\text{Install. A} = 6.936.777$$

4.1.2 Simple Additive Weighting Methode (SAW) Simulation

In the vehicle credit approval decision-making process, the proposed approach involves assigning weighted scores to the application documents received by the Sales Supervisor using the Simple Additive Weighting (SAW) method. The evaluation stages using the Simple Additive Weighting method are as follows.

A. Alternative Determination
In this study, customer alternatives will be assessed in terms of feasibility from P1 to P3 with the following description.

$$W = [W1, W2, W3, \dots\dots\dots\dots\dots\ Wj]$$

P1 : Customer 1
P2 : Customer 2
P3 : Customer 3

B. Assessment Indicators
The assessment indicators given to customers based on the submitted requirements are converted into integer values for calculation. The weighting details are as follows.

B1. Financial Percentage

$$FP = 100\% - \left(\frac{Proposed\ Monthly\ Installment}{Monthly\ Income +\ Additional\ Income - Monthly\ Expense}\right) \times 100\%$$

With the following value weighting categories

Table 1. Percentage Of Financial Value

Percentage	Grade
< 30%	0
30% - 40 %	2
41% - 60 %	4
>60%	6

B2. Home Ownership

Table 2. Home Ownership Value Weighting

Status	Grade
Lease	1
Join Other	2
Private	3

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B3. Garage Ownership

Table 3. Garage Ownership Value Weighting

Garage Ownership	Grade
No	1
Rent	2
Exist	3

B4. Credit History

Table 4. Credit History Value Weighting

Category	Grade
Bad	0
Under Control	1
New Application	2
Great	3

C. Determine the Rating Scale

Table 5. Performance Assessment Scale

Category	Grade
Approve	>2
Not Approve	=< 2

Table 6. Customer Rating

ID Cust	Fi	HO	GO	*GH*
7000001	4	2	2	3
7000002	2	1	3	2
7000004	4	1	3	0

Table 7. Match Rate

	C1	C2	C3	C4
P1	4	2	2	3
P2	2	1	3	2
P3	4	1	3	0

D. Create A Decision Matrix

$$X = \begin{pmatrix} X_{11}\, X_{12} \ldots\ldots X_{1j} \\ | \\ X_{i1}\, X_{i2} \ldots\ldots X_{ij} \end{pmatrix}$$

$$\mathbf{R} = \begin{matrix} 4 & 2 & 2 & 3 \\ 2 & 1 & 3 & 2 \\ 4 & 1 & 3 & 0 \end{matrix}$$

E. Normalitation Matrix

In this section, normalization is performed by applying Equation (2).

r13= $\frac{2}{MAX(2,\ 3,\ 3)} = 0{,}67$

r23= $\frac{3}{MAX(2,\ 3,\ 3)} = 1$

r33= $\frac{3}{MAX(2,\ 3,\ 3)} = 1$

r14= $\frac{3}{MAX(3,\ 2,\ 0)} = 1$

r24= $\frac{2}{MAX(3,\ 2,\ 0)} = 0{,}67$

r34= $\frac{0}{MAX(3,\ 2,\ 0)} = 0$

$$R = \begin{pmatrix} r_{11}\ r_{12} \ldots\ r_{1j} \\ \\ r_{i1}\ r_{i2} \ldots\ r_{ij} \end{pmatrix}$$

1	1	0,67	1
0,5	0,5	1	0,67
1	0,5	1	0

F. Decision Making Process

The results of the normalized matrix are then used to perform calculations in determining decisions. The calculation in this section is performed using Equation (1).

P1 = {((0,8*1)+(0,8*1)+(0,8*0,67)+(0,8*1))} = 2,94

P2 = {((0,8*0,5)+(0,8*0,5)+(0,8*1)+(0,8*0,67))} = 2,14

P3 = {((0,8*1)+(0,8*0,5)+(0,8*1)+(0,8*0))} = 2

Table 8. Match Rate

Alternate	Category				Grade	Explan
	C1	C2	C3	C4		
P1	1	1	0,67	1	2,94	Approve
P2	0,5	0,5	1	0,67	2,14	Approve
P3	1	0,5	1	0	2	Not Approve

The calculation results indicate that P3 is classified as not approved due to an evaluation score of 2.

4.2 Analysis and Design

This section presents the design of the application that incorporates the Simple Additive Weighting (SAW) method.

A. Use Case Diagram

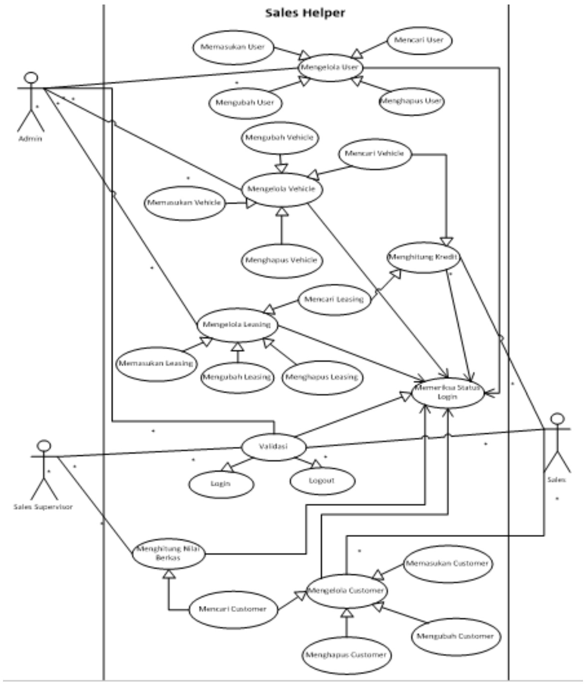

Figure 2. Use Case Diagram of Sales Helper

B. Class Diagram

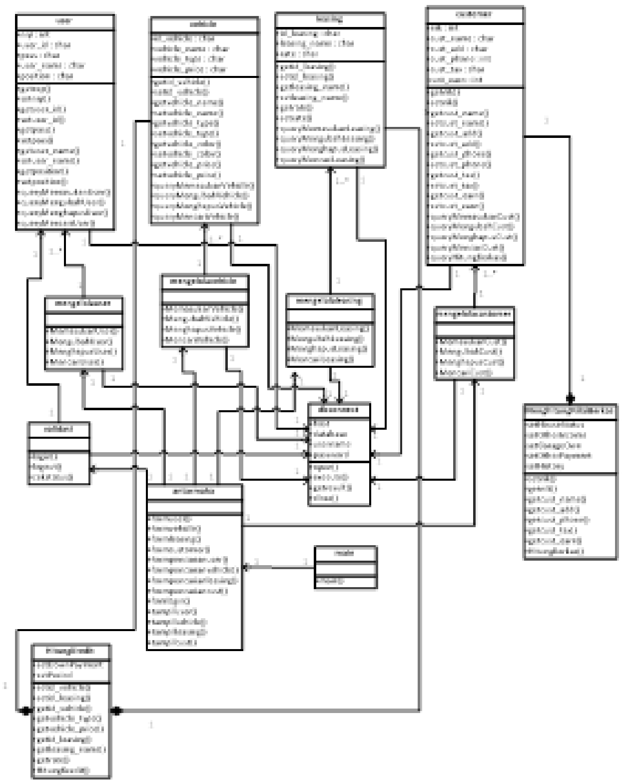

Figure 3. Class Diagram of Sales Helper Apps

C. Object Diagram

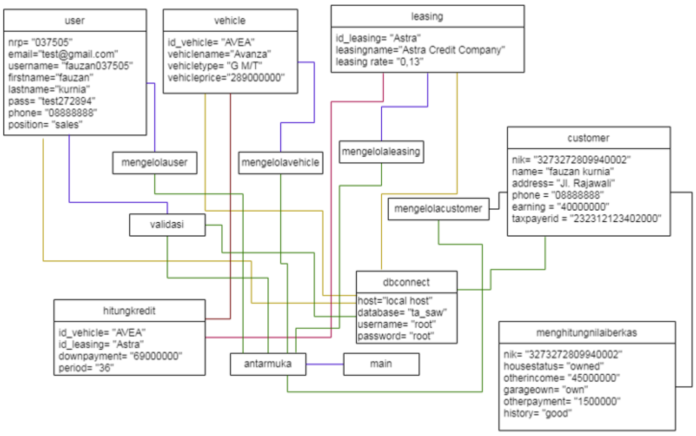

Figure 4. Object Diagram Of Sales Helper Apps

D. Sequential Diagram

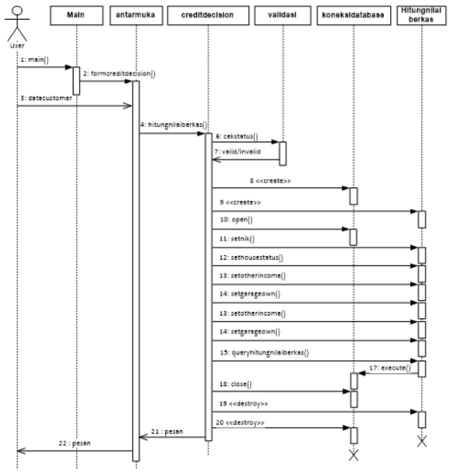

Figure 5. Sequential Diagram of Credit Analysis

E. Activity Diagram

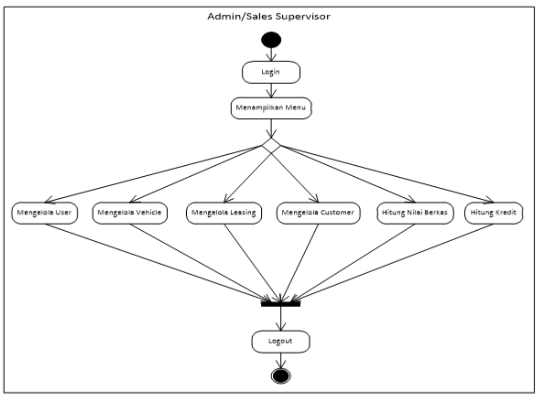

Figure 6. Activity Diagram of User Admin and Sales Supervisor

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F. Design Interface

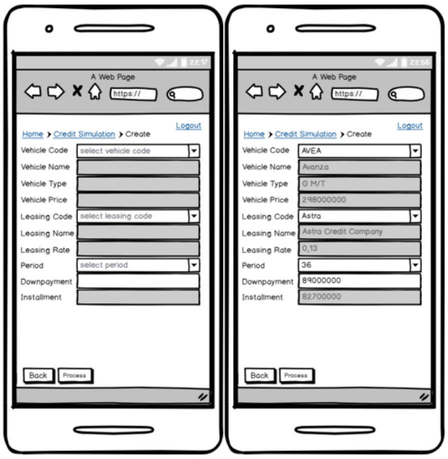

Figure 7. Credit Simulation Design

4.3 Testing and Implementation

This section presents the implementation of the previously designed system into an application, followed by testing to verify whether it meets the specified requirements.

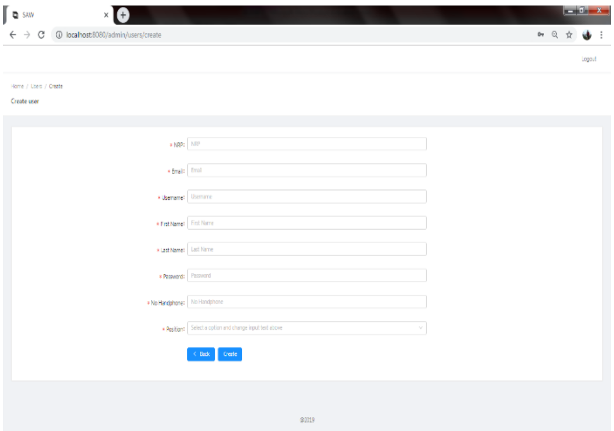
Figure 8. Create Data User Interface

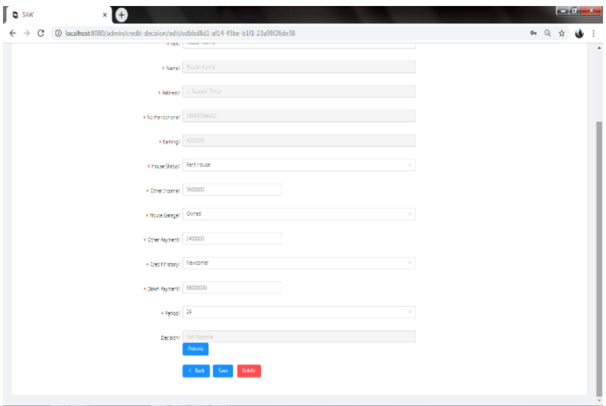
Figure 9. Edit Credit Decision Interface

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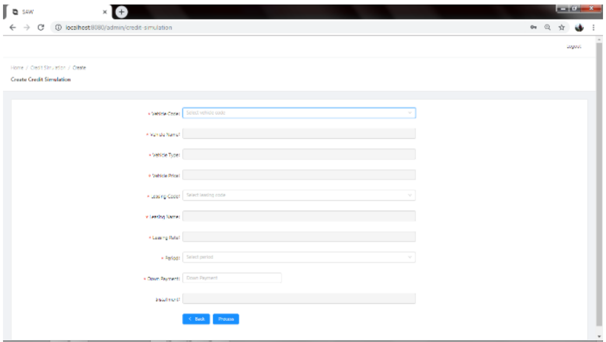
Figure 10. Credit Simulation Interface

Following the application implementation, the system was tested using the black-box testing method. The test results indicate that the developed application operates correctly and that the analysis results of customer credit applications are consistent with the users' manual analysis.

5 CONCLUSSION

This study concludes that a web-based credit simulation application can be successfully implemented to improve the efficiency of sales personnel in conducting vehicle credit simulations, particularly when operating outside the office. Furthermore, the Sales Helper application, which applies the Simple Additive Weighting (SAW) method as a decision support system, effectively supports sales supervisors in making vehicle credit approval decisions and reduces the risk of approving non-credible applicants.

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