International Journal of Computer Science and Engineering Innovations
ISSN: 3107-9458 | Volume 2 Issue 4, 01-07, October-December 2026
DOI: https://doi.org/10.64137/31079458/IJCSEI-V2I4P101

Scholastic Research Publication

Received: 10//09/2026 Revised: 22/09/2026 Accepted: 28/09/2026 Published: 01/10/2026

Original Article

Design and Development of a Web-Based Decision Support System for Used Car Selection Using Simple Additive Weighting Method to Provide Accurate and Fast Recommendations for Showroom Customers

[1]LIYANDO HERMAWAN HASIBUAN, [2]ACHMAD ARIF MUNAJI
[1]Department of Informatics Engineering, University of Palangka Raya, Indonesia.
[2]Department of Informatics Engineering, Institut Teknologi dan Sains Nahdlatul Ulama Kalimantan, Indonesia.

ABSTRACT: *The selection of used cars to choose from can be overwhelming for potential buyers, and the variables, like price, engine specifications and production year, are quite complex. This study develops a DSS in the form of a web-based application designed for fast and accurate recommendations regarding vehicle selection. They use the Simple Additive Weighting (SAW) method, which calculates the total of performance ratings given to each alternative over multiple criteria to find the best option for decision-making. The development proceeds with the Waterfall model, which includes requirements analysis, system design (DFD and ERD), implementation (PHP and MySQL), and functional testing (Black Box). The decision process considers seven parameters Brand, Price, Engine Specs, Transmission, Mileage, Description and Year of Production. Results show that the system generates a preferred order of the car options, assigning these criteria different levels into specific priority weight values that ease the buyer in choosing their ultimate car choice. This application will be important as a tool to raise efficiency and accuracy of selection in used car showrooms by bridging the knowledge gap between customers.*

KEYWORDS: *DSS, SAW Method, Used Cars, PHP, Waterfall Model.*

1. INTRODUCTION

During the last decade or so, we have seen a particularly speedy growth of information technology, which has had a clear-cut effect on human lifestyles, as much because it pertains to completely incorporated computing and digital techniques in disciplines such as education, health, and commerce. The advancement of technology plays an important role in the sale and purchase of a product; technology serves as an essential link from sellers to buyers, where vendors will promote products worldwide through any medium connected to the Internet. However, though this digital transformation provides never-before-seen convenience, it also brings with it the problem of "information overload." The sheer volume of data accessible to potential customers can overwhelm them, resulting in confusion and not knowing the best possible option from the many products available.

In the automobile industry, motorized vehicles have developed as a key need for day-to-day activities in life and moving around professionally. As cars evolve from coveted goods to necessary instruments for work and schooling, ownership rates multiply in nations like India and Indonesia. [1] Deep technical insights, the type that can easily lead to an expensive misselection, are ideal when buying a car, especially secondhand. Consumers quickly second-guess their own knowledge either due to a lack of expertise about condition or simply by not remembering and being able to compare the exhaustive technical details such as interior/exterior accessories, seating capacity, MPG efficiency, and production years. This uncertainty and lack of objective data often leads buyers to opt for a vehicle that is not entirely suited to their functional requirements or budget.

The modern market for vehicles is a highly competitive one, where car manufacturers race each other on innovation to create a vehicle with various features, including hybrid and electric, determined by the potential growth of their respective companies. As a result, there are so many options available in the showrooms, and consumers have to deal with Multi-Criteria Decision Making (MCDM) problems [2]. Selecting an appropriate car entails a concurrent evaluation of competing dimensions, for instance, cost (price) versus performance, safety and comfort (benefits). Decision Support System (DSS) tool becomes relevant in such complex scenarios to help users take accurate and data-driven decisions. A DSS integrates an individual's intelligence with relevant data in a rational way to facilitate the unstructured or semi-structured decision-making process [3].

The Simple Additive Weighting (SAW) is one of the best, simplest and easiest decision-making techniques you can ever find. SAW Models, also known as the weighted addition method, sum the product of performance ratings to score each alternative

This work is an open access and licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 License
(https://creativecommons.org/licenses/by-nc-nd/4.0/)

against all criteria. It is, specifically, very robust since the method needs to scale and normalize the decision matrix onto an equal base, therefore enabling analysis of criteria with different units and values. Each alternative can be clearly ranked as a composite determination of the performance of each option on all attributes, which allows the user to easily see how alternatives compare against one another and receive an answer in accordance with their own specific needs through the addition of weights to differentiate between them based on their specified importance[4].

Research with the title Design and development of a web-based decision support system for used car selection using the simple additive weighting (SAW) method is research that aims to provide a solution bridge between customer desires and available showroom stocks. The system is implemented as a web application utilising PHP and MySQL[5], which makes the process interactive, intuitive and simple. This study incorporates seven core parameters to guide the decision Process: Brand, Price, Engine Details, Transmission, Mileage, Description and Production Year. This research is implemented at venues including Bejo Motor Palangka Raya in order to speed up the decision-making process for potential buyers as well as to find good alternative vehicles. The system is also designed to assist showroom owners in enhancing their sales turnover and customer service via the provision of correct, digitized data regarding vehicles.

2. METHODOLOGY

The research methodology for this project integrates two primary frameworks: the Waterfall Model for software development and the Simple Additive Weighting (SAW) method for the core decision-making logic. This structured approach ensures that the system is built on a solid technical foundation while providing a scientifically valid way to rank used car alternatives based on multiple conflicting criteria.[6]

2.1. DATA COLLECTION AND PRELIMINARY RESEARCH

In the first phase, the data required to model the system is collected through a multi-method approach. Observational Study: Research was carried out through direct observation at local showrooms, including Bejo Motor Palangka Raya, to gain insight into the manual process used in choosing a vehicle and where buyers fall into "information overload".

User Interviews: We conducted interviews with showroom admins and potential buyers to understand the most relevant parameters for selecting a car. Literature Review: This was a review of existing decision-support theories, in particular exploring Multi-Criteria Decision-Making (MCDM) strategies and global Journals on vehicle selection systems. [7]

2.2. SOFTWARE DEVELOPMENT LIFECYCLE (THE WATERFALL MODEL)

To build the web-based application, this study utilizes the Waterfall model by Sommerville (2004), which follows a sequential, phase-based lifecycle.

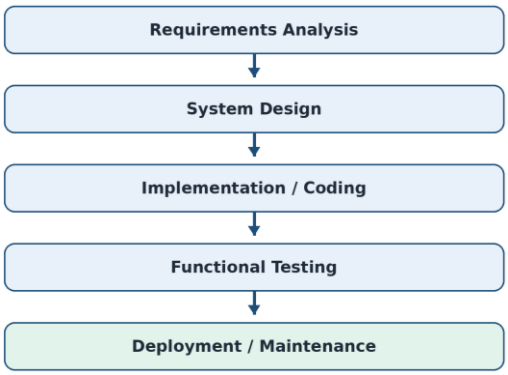


FIGURE 1 The Waterfall Model by Sommerville (2004)

Identify requirements: In this step, we identify what the end-users would need. This will include defining the seven decision parameters (Brand, Price, Engine Specs, Transmission, Mileage, Description and Year of Production. For system design, we create technical blueprints that chart data flow. For this purpose, it employs Data Flow Diagrams (DFD) to explain how user inputs (i.e., criteria weights) pass through the database (car specifications) and also Entity Relationship Diagrams (ERD) that will come up with a functioning design or base architecture of the database by developing tables for users, criteria and sub-criteria, along with tables for car details. Coding (Implementation): Designs are transformed into a functional product, which uses PHP as the server-side language and MySQL as the relational database management system. Using HTML, CSS and JavaScript, members of the community get an interactive web interface to easily insert their preferences. Functionality Testing: Black Box Testing is performed where the internal code structure of the application is not looked at. This will ensure that the login module, criteria management and SAW ranking generation all work correctly and give the expected results to the user. [8]

2.3. THE DECISION-MAKING LOGIC (THE SAW METHOD)

At its heart, the system is based on the [9] (SAW) method, which is often referred to as weighted addition. The method is composed in a clear, logical manner to solve multi-objective problems. Criteria Categorization: Each class of car specifications shall be classified as Benefit or Cost. In the case of benefit criteria such as Production Year or Engine Capacity, a larger value is better. In the case of cost criteria (Price), a lower number is better for the consumer. [10]

Weight assignment mechanism: Each criterion is assigned an importance level, usually determined either by the system administrator or based on the user's requirements. The latter is a reminder that the same buyer will have one person land on the temperature to them; they want the lower price, but it might be their Calvert 1995 Richebourg (more than two generations newer) who quite happily paid- mas what are now pretty considerable bills. Normalization Step: Given that car data uses various units such as currency for price and years for age, the SAW method includes a normalisation step. That step prepares every piece of raw data to be in a standardized range from zero to one, making it possible for different attributes to be compared with one another. Weighted Summation and Ranking: To calculate a value of preference for each car, we multiply the normalized performance in each category by the weight (importance) of that category. Basically, all these values are summed together to get a single overall score. [11]

Result: The vehicle is sorted automatically by the scoring method in decreasing order, and the best alternative is prioritized-out to the buyer as it has been recommended based on their criteria.

3. ANALYSIS OF THE LEGACY SYSTEM

The legacy system that is currently running at most used car showrooms, such as Bejo Motor Palangka Raya, uses a traditional and cumbersome business process in working around this. In this conventional workflow, prospective customers often browse through the presented offers of available vehicles and choose one based on what they see and additional information given by employees.

Nevertheless, this manual method has numerous major weaknesses: Information Gap and Memory Reliance: Potential customers find it difficult to consolidate or remember technical specifications among several vehicles. Things like interior/exterior accessories, specific engine displacement of engines even the production year are often not highlighted enough, which results in you selecting the wrong model and landing up regretting your choice after a while. Data Overload: Manufacturers continually churn out new types of vehicles with different strengths, but all the information overload can difficultize decision making for buyers. The information available is almost exclusively raw data, and without a systematic comparison tool, the consumers are unable to make sense of this 'information-overload'.

Sales Restrictions: In many cases, key account managers are unable to make objective recommendations for sales solutions in rapid succession that perfectly align with customer requirements. If there is no standard calculation model, the recommendations may still come out being subjective or even inconsistent. Poor Decision Making: A manual system may mean the final purchase does not match what the buyer really wanted, as there's no formal mechanism to measure competing imperatives. eg, a lower price vs. a newer year of production.

4. COMPREHENSIVE RESEARCH OVERVIEW

This research, titled "Design and Development of a Decision Support System for Used Car Selection Using the Simple Additive Weighting (SAW) Method," seeks to solve these manual inefficiencies by providing a web-based automated solution.

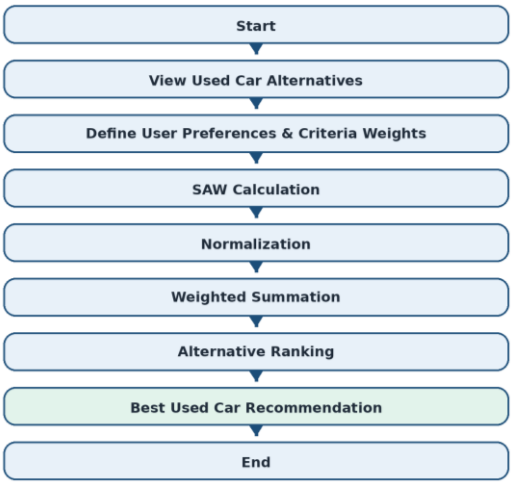


FIGURE 2 Comprehensive Research Overview

4.1. THE DECISION-MAKING FRAMEWORK (SAW METHOD)

The core intelligence of the system is built upon the Simple Additive Weighting (SAW) method, a fundamental technique in Multi-Criteria Decision Making (MCDM). The SAW method was chosen because it calculates the weighted sum of performance ratings for every alternative across all defined criteria. Normalization: The system processes criteria by normalizing a decision matrix into a scale from 0 to 1, allowing for the comparison of different units (e.g., price in currency versus engine size in CC). Attribute Classification: It distinguishes between "Benefit" attributes (where higher values like the production year are better) and "Cost" attributes (where lower values like the price are preferred). By multiplying these normalized values by weights assigned to each criterion, the system produces a final preference value (Vi), where the highest score indicates the best alternative for the buyer.

4.2. SYSTEM DEVELOPMENT LIFECYCLE (WATERFALL MODEL)

The basics of the project are described in the Waterfall Model (Sommerville, 2004) such that a programmed structure and stable software build can be ensured. This follows a sequential process which consists of the following. Requirements Analysis: This involves understanding both administrators' and buyers' requirements through observation and interviews. System Design: This includes blueprints such as Context Diagrams, Data Flow Diagrams (DFD), and Entity Relationship Diagrams (ERD) to describe how car data and user priorities flow through the system.

Development (Programming): Converting the designs into a web application using PHP language for the server, HTML/JavaScript as an interface, and MySQL for database management. Testing: Testing the functional spec of what a user should see if they click on login at her height. Black-box testing will be conducted to ensure all things she will do, such as logging in, managing conditions and ranking, run smoothly.

4.3. KEY PARAMETERS AND TECHNOLOGICAL STACK

The DSS considers used cars using the following seven primary parameters: DSS Brand, DSS Price, DSS Engine Specs, DSS Transmission, DSS Mileage, DSS Description and production year. The application is built on Intel Core i5 with 4 GB RAM hardware, Sublime Text as a code editor and XAMPP as a local server environment.

4.4. RESEARCH OBJECTIVES AND BENEFITS

The ultimate goal of this research is to create a tool that accelerates the decision-making process for the public. For buyers, it provides a scientifically backed recommendation that reduces the risk of error. For showroom owners, the system acts as a digital catalog that improves customer service transparency and has the potential to increase sales turnover by helping clients find their ideal vehicles more efficiently.

5. RESULTS AND DISCUSSION

5.1. ANALYSIS OF THE LEGACY SELECTION PROCESS

Based on investigative observations conducted at automotive showrooms, such as Bejo Motor Palangka Raya, the existing system for vehicle selection was found to be entirely conventional and manual. In this legacy workflow, prospective buyers typically visit the showroom and browse through available car offers by physically inspecting the vehicles or relying on verbal technical descriptions provided by sales staff.

However, this manual solution has some serious drawbacks. For one, due to the number of cars available, dozens of choices usually include tech specs like engine displacement, transmission types and production years; buyers have a hard time grappling with "information overload." Third, a giant "information gap" exists: buyers do not have the technical expertise to examine these specifications comparatively or simply forget particulars as they consider. Lastly, because there are no formal processes for evaluating competing priorities, like the decision between a budget from 2020 and a desire for a newer model year choice cannot be compared in an objective way, opening up room for error that results in buyer regret post-purchase.

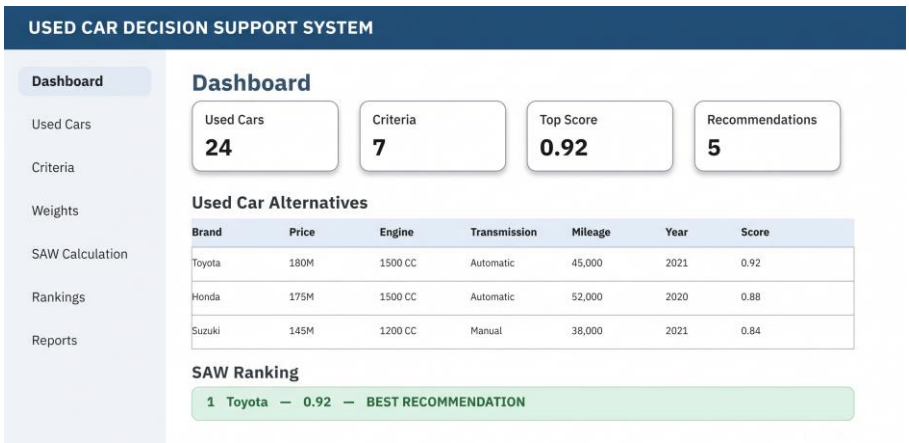


FIGURE 3 Decision Support System Web

5.2. OVERVIEW OF THE PROPOSED DECISION SUPPORT SYSTEM

Thus, the proposed solution traditionally adopts a web-based Decision Support System (DSS) that complements this process by automating and objectifying vehicle recommendations. This system converts car selection from a task that relies on memory to one that is data-driven, where each attribute of the vehicle is stored within a structured MySQL database. Two main user types with different access control are defined by the system architecture:

- Administrator: An administrator is responsible for maintaining the digital inventory, such as adding, editing or deleting car alternatives. Admin also handles weight values of each decision criterion according to market trends or expert literature.
- Buyer: Available to access a customized dashboard with the used car ranking, which provides them a priority list with scientific backing fill the information gap and finalize purchase.

5.3. DETAILED SYSTEM IMPLEMENTATION

The implementation stage consists of converting the designed technical architecture, like Data Flow Diagrams (DFD) or Entity Relationship Diagrams (ERD), into a working software application. The application was developed in PHP, which is one of the core server-side scripting languages used for dynamic communication between the user interface and backend data stores. XAMPP was used as a local server environment, which combined the Apache Web Server and MySQL database engine. The software utilized in the implementation was designed on hardware consisting of an Intel Core i5 microprocessor with 4 GB RAM, enabling arithmetic calculations supporting the decision-making algorithm to occur instantaneously. The interface was developed to be interactive, containing a centralized login portal, a car management module that covers the seven core criteria: Brand, Price, Engine Specs, Transmission, Mileage, Description and Production Year, as well as a specialized ranking page where results are presented to users.



FIGURE 4 Decision Support System Web result

5.4. LOGICAL EXECUTION OF THE SAW METHODOLOGY

The intelligence of the system is powered by the Simple Additive Weighting (SAW) method, which follows a logical, step-by-step process to rank used cars without requiring the buyer to perform any manual calculations.

- Criteria Classification: The system first categorizes each vehicle specification into two types. "Benefit" attributes are those where a higher value is more desirable (such as the production year or engine capacity), while "Cost" attributes are those where a lower value is preferred by the buyer (specifically the car's price).
- Normalization Process: Because car data involves different units—such as currency for price and years for age—the system performs a normalization step. This process scales all raw values into a uniform range between 0 and 1, making it possible to compare "apples to oranges" objectively.
- Weighted Summation: The system multiplies each car's normalized score by the importance weight assigned to that specific criterion. For example, if a buyer prioritizes price over mileage, the price score will have a larger impact on the final result.
- Final Prioritization: The results are summed to produce a single preference value for each car. The system then automatically sorts the entire inventory from the highest score to the lowest. The vehicle with the score closest to 1.0 is presented as the top recommendation, providing a clear, scientifically backed choice for the customer.

5.5. FUNCTIONAL TESTING AND VALIDATION

This works well, but it needed to be reliable enough for a real-world showroom deployment of the system, which required extensive Black Box Testing. This method of testing stores the outputs from the function from a software perspective. The

system was able to validate valid users and reject unauthorized users and also displayed appropriate Login Failed messages for incorrect inputs. Data Integrity Testing: Successful insertion, updates and deletion of car specifications in database tables through test cases verifying the absence of data loss or corruption. Algorithmic correctness: The most important test contained comparing results between the ranking of the single system with manual mathematical verifications. The system source score accuracy output proved that the automated SAW ranking engine logic is mathematically valid and works as designed.

5.6. DISCUSSION OF SYSTEM IMPACT

These findings indicate that the DSS intelligent system greatly reduces the cost of the used car selection procedure. The system also replaces a manual search process with an automated ranking module, thereby allowing the identification of ideal vehicles in seconds rather than minutes or hours for a buyer. The system serves as a closet for the showroom owners to digitally inventory their goods, in addition to a reporting tool that streamlines professional transparency and trust among customers. The system for customers is an objective filter that cuts through the "information overload" fog. Thus, the short and long of it is that using the SAW method provides integration through a relevant and true comparison between technical specs weighted against your unique budget requirements rather than arbitrary sales pressure points.

6. CONCLUSION

This paper presents the web-based Decision Support System (DSS) for used car selection, which has been developed successfully, fulfilling its targets that serve as a systematic solution to difficulties involving the automotive market. Based on the analysis, implementation and testing phases, we can derive a few conclusions:

Successful System Implementation: The design and construction of a DSS that worked with the Waterfall development model, from requirement analysis, system design (DFD and ERD), and coding with PHP and MySQL. What this does is move the vehicle selection from a physical, memory-based activity to a digitized data-based process.

Methodologically, the effectiveness of applying the Simple Additive Weighting (SAW) method is explicitly clear for this multi-objective problem. The system then objectively ranks car alternatives by calculating their weighted sum of performance ratings. So, it can resolve competing criteria; for instance, it can optimize for the "cost" of price while also optimizing for the continued "benefits" of production year and engine specs to get what that user should have.

Improved Decision-Making for Buyers: The system successfully tackles the two issues of "information gap" and "information overload". The recommendation of the cars is given in a prioritized list where the highest-scoring car (closest to 1.0) is at the top, thus allowing potential buyers to make quicker and better decisions without deep technical experience or needing to remember large amounts of data. Operational Advantages to Showrooms: The DSS is a digital catalog and analytical resource that provides higher service transparency for showroom owners and sales staff. This allows sellers to make consistent and neutral recommendations to consumers, which can ultimately result in greater customer satisfaction and increased items sales turnover. System Safety and Precision: Functional validation through Black Box Testing confirmed that all modules user authentication, car data management and the SAW Calculation Engine are functioning based on requirements. Manual mathematical calculations matched system-generated rankings 100% of the time, which validated the recommendations. To summarise, by means of the integration of a web-based solution for the SAW method, we have developed a tool that considerably reduces the time spent on selecting used cars with an effective methodology from both the side of end-consumers and automotive dealers.

REFERENCES

[1] Banoth Nikhil Kumar, “Selection of Car Using Fuzzy AHP and Fuzzy TOPSIS Method by MCDM Approach,” Aug. 2023, doi: 10.31224/3188.

[2] F. Tscheikner-Gratl, P. Egger, W. Rauch, and M. Kleidorfer, “Comparison of Multi-Criteria Decision Support Methods for Integrated Rehabilitation Prioritization,” Water, vol. 9, no. 2, p. 68, Jan. 2017, doi: 10.3390/w9020068.

[3] Susanto, L. Latifah, Nuryasin, and A. Fitriyani, “Decision support systems design on sharia financing using Yager’s fuzzy decision model,” 2017 5th International Conference on Cyber and IT Service Management (CITSM), Aug. 2017, doi: 10.1109/citsm.2017.8089263.

[4] M. W. L. Moreira, J. J. P. C. Rodrigues, V. Korotaev, J. Al-Muhtadi, and N. Kumar, “A Comprehensive Review on Smart Decision Support Systems for Health Care,” IEEE Systems Journal, vol. 13, no. 3, pp. 3536–3545, Sept. 2019, doi: 10.1109/JSYST.2018.2890121.

[5] X. Shi, B. Dai, L. Li, X. Li, and M. Shi, “Construction of an online crisis decision support system,” 2010 IEEE 2nd Symposium on Web Society, Aug. 2010, doi: 10.1109/sws.2010.5607422.

[6] Novrina, R. N. Sari, and D. E. Fadjri, “Implementation of Decision Support on the Selection of Hybrid Vehicles Using Saw Method,” International Journal of Advances in Engineering and Management (IJAEM), vol. 4, no. 1, pp. 744–751, Jan 2022, doi: 10.35629/5252-0401744751.

[7] S. Sathyapriya, P. B. Seeli, and R. Swathi, “Selection of Cars Using Combined Multi Criteria Decision Making Techniques,” International Journal of Creative Research Thoughts (IJCRT), vol. 6, no. 1, pp. 832-841, Jan 2018.

[8] Sommerville, Software Engineering, 9th ed. Boston: Pearson Education, 2011.

[9] Afshari, M. Mojahed, and R. M. Yusuff, “Simple Additive Weighting Approach to Personnel Selection Problem.,” International Journal of Innovation and Technology Management, vol. 1, no. 5, pp. 511–515, Dec. 2010, doi: 10.7763/IJIMT.2010.V1.89.

[10] Ramadhan and U. Zaky, “Method Comparison Analysis Simple Additive Weighting (Saw) With Weighted Product (Wp) Method in Supporting the Decision To Accept New Employees,” International Journal of Engineering Technology and Natural Sciences, vol. 2, no. 1, pp. 11–17, 2020, doi: 10.46923/ijets.v2i1.66.