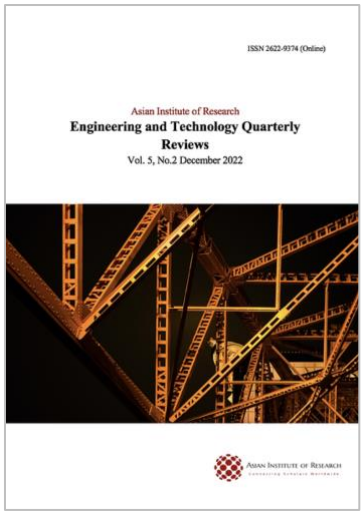


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# Recommendation System for Boarding House Selection using Simple Additive Weighting Method

Yogi Maulana Krisna[1], Adhi Kusnadi[2], Fenina Adline Twince Tobing[3]

[1,2,3] Informatics Departement, Engineering and Informatics faculty, Universitas Multimedia Nusantara, Tangerang, Indonesia

Correspondence: Adhi Kusnadi. Email:adhi.kusnadi@umn.ac.id

**Abstract**
The selection of boarding houses for work or study often leaves potential residents uncertain about choosing the right boarding house to meet their daily personal needs. Due to the varying prices and facilities offered by each boarding house, potential residents need to consider the prices and various facilities provided by each boarding house. Therefore, a recommendation system is needed to assist potential residents in deciding on the right boarding house according to their daily needs. This system is created using the Simple Additive Weighting method, which can help potential residents in decision-making through ranking obtained by multiplying the matrix of each criteria weight with the available alternative values. The development of this recommendation system uses MYSQL database, HTML, PHP, and JavaScript programming. The testing of the recommendation system using a Likert scale resulted in an average total interpretation score of 76.3%, indicating that users have a positive response to this recommendation system.

**Keywords:** Recommendation System, Boarding Houses, Simple Additive Weighting

## 1. Introduction

The body of a manuscript opens with an introduction that presents the specific problem under study and Boarding house is a rented room that can be rented by various people such as employees and students for a period agreed upon by the owner and the prospective tenant. Since boarding houses are usually rented by employees and students as temporary places of residence while working or studying, the rental period is generally 1 year or more (Afma et al., 2019). Boarding houses serve as temporary homes, study places, and resting places. In addition, boarding houses play an important role in motivating students to study based on the facilities and environment they provide (Khaing & Ye, 2018). Some universities do not have temporary residence facilities or dormitories for students, so boarding houses often become a choice for temporary residence, or the available facilities cannot accommodate

all active students of the university, such as Multimedia Nusantara University, Gading Serpong Tangerang Banten Indonesia.

Based on the rapid development of Gading Serpong area where UMN campus is located, as it can be directly accessed through Jakarta-Merak toll exit, there is an increasing business prospect in this area, opening up new opportunities for residential development, shopping centers, schools, universities, and office buildings. Choosing the right boarding house to rent is crucial because the comfort experienced can affect work or study productivity while staying there (Adams, 2020). However, due to the various criteria that each boarding house possesses, which need to be considered by prospective tenants, such as monthly rental price and distance from the boarding house to work or study place, searching for a boarding house can be challenging for prospective tenants (Maalsen & Gurran, 2022).

The difficulty in choosing the right boarding house according to the needs of students can be overcome by using a decision support system. It is said that a decision support system can provide ease in making decisions, both in structured and unstructured conditions (Zuiev et al., 2020). The purpose of creating this system is to provide assistance in decision-making when no one knows how the decision should be made [8]. This decision support system can calculate the advantages and disadvantages of existing boarding houses, allowing it to recommend the right boarding house.

There have been previous studies on similar recommendation systems, such as the studies (Shen et al., 2020) (Satapathy et al., 2020) and the study (Guy, 2017)(Kusnadi & Kurniawan, 2017)(Kusnadi et al., 2016), which are closely related to this research topic, discussing the development of a recommendation system using the Object-Oriented Systems Analysis and Design (OOAD) approach for system development. The system was developed as a Web application using the Ruby on Rails framework. Therefore, research on using algorithms for boarding house selection is still limited, and this study also has the characteristic of focusing on a different region, namely Gading Serpong, Tangerang, Banten.

One of the algorithm methods that can be implemented in the decision support system is the Simple Additive Weighting (SAW) method (Devi & Sihotang, 2019). SAW, also known as the weighted sum method, is one of the various methods that can be used to solve decision support problems with multiple criteria (Abdel-Basset et al., 2019). Essentially, the SAW method is a method that seeks the total weighted sum of each alternative from the performance matrix values (Tuş & Aytaç Adalı, 2019). The SAW algorithm method requires normalization of the decision matrix so that it can be processed by multiplying the matrix with all predetermined alternative values (Rizkiyanto, 2022). The advantages of the SAW method compared to other decision support methods are that this method is based on pre-determined criteria values and preference weights, allowing for more accurate assessment. Additionally, the SAW method ranks each alternative based on the assigned weight values, resulting in the selection of the best alternatives from all available options (Akinsola et al., 2019). Previous studies have shown that the SAW method can accelerate the assessment process, produce accurate weight calculations, assist in more objective and computerized decision-making, and reduce human errors. Based on this background, this research will also use the SAW method to facilitate users in selecting boarding houses that meet their criteria.

## 2. Method

System development method using System Development Life Cycle (SDLC). SDLC can serve as a means of communication between developers and clients regarding software requirements and can also reduce the required costs. There are 6 stages of work within the SDLC methodology. Those stages are:

1. Literature Study
   In this stage, theories and practices related to the design and development of room rental recommendation systems are studied.
2. Data Collection
   Data is collected from room rentals on the mamikos.com website, using 5 criteria for selecting a boarding house: distance to campus, room size, distance to restaurants, rating, and price.
3. System Design and Development

Design is done using DFD, and implementation is done using the CodeIgniter framework and PHP as the backend language for the website.

4. System Testing
   Testing is conducted by comparing manual calculations with the system's results.
5. Evaluation
   After the recommendation system is developed, it will be evaluated based on user satisfaction levels.
6. Completion
   Once the recommendation system is completed, it will be evaluated based on user satisfaction.

## 2. Design

Data Flow Diagram (DFD) illustrates the flow of data interaction between system users and the system itself, as depicted in Figure 1. The Figure shows the data flow of the level 0 of the room rental recommendation system. The entity that communicates with the recommendation system is the user (room seeker). The user entity has 3 types of data flow with the recommendation system, namely inputting room data, inputting weight data, and receiving room rental recommendations. The inputting room data data flow shows that the user can input new room data.

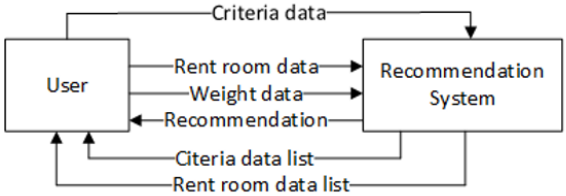


Figure 1: DFD System Recommendation

The inputting weight data data flow shows that the user can input new weight criteria. In the room rental recommendation data flow, the system displays the results of the Simple Additive Weighting (SAW) calculation with the previously inputted weights. The database has 3 types of data flow with the recommendation system, namely room data, weight data, and SAW calculation results data. In the room data data flow, the system retrieves room data to display to the user on the room rental data page. In the weight data data flow, the system retrieves weight data to display to the user. In the SAW calculation results data flow, the system sends the calculated SAW results data to the database."

Simple Additive Weighting (SAW), also known as weighted sum method, is a method used for decision-making. The steps to use this method are as follows:

1. Determine the criteria that will be used for recommendation.
2. If the criteria have non-quantitative values, find alternative values for those criteria.
3. Determine the weights for each criteria as references for the recommendation.
4. Create a decision matrix with the values of each criteria used.
5. Normalize the decision matrix that has been obtained.

After obtaining the normalized matrix, the next step is to multiply the criteria weights with the normalized matrix, where the values of each column in the matrix are multiplied with each weight. Then, the values of each row in the criteria column of the matrix will be summed to obtain the preference value."

## 3. Implementation

The system specifications used for system development are as follows: Hardware - Processor: Intel Core i3-2310M, GPU: NVIDIA GEFORCE 610M, RAM: 8GB, Storage: 500GB. Software - OS: Microsoft Windows 10, Browser: Google Chrome, SublimeText, XAMPP, and PHP. Next is the interface image of the system (Figure 2).

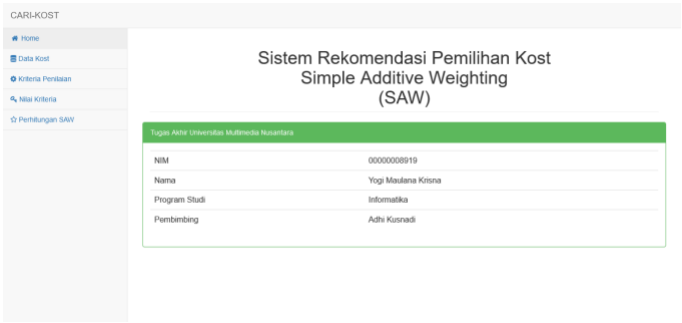


Figure 2: Home Interface of System Recommendation

Figure 2 is the home page of the recommendation system, which includes the necessary features such as data updates and the recommendation system

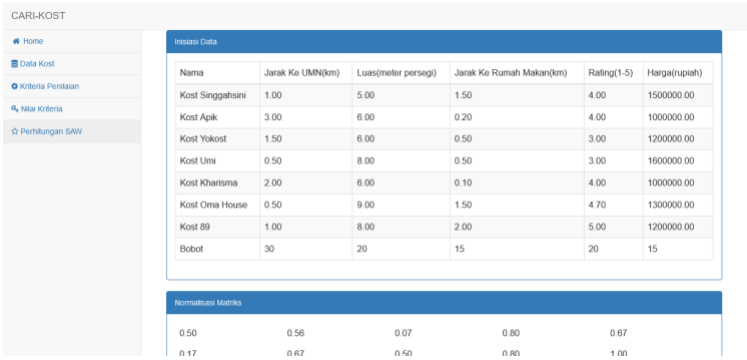


Figure 3: System Recommendation Results

Figure 3 shows the results of the SAW calculation process. After the process is completed, four data will appear, namely initialization data, matrix normalization, matrix normalization x weight, and ranking.

```
for(var j=0; j<sampel.length; j++){
    var ranking = 0 ;
    $.ajax({
        method: 'post',
        url: 'service.php?page=nilai&action=getSampel',
        async: false,
        data: {sampel_id:sampel[j].id},
        success: function(resp) {
            var elmDOM = '<tr><td>'+ sampel[j].nama +'</td>';
            var matrikDOM = '<tr>';
            var matrikBobotDOM = '<tr>';
            var res = JSON.parse(resp);
            var sum = res.reduce(function (s, a) {
                return s + parseInt(a.bobot);
            }, 0);
            if(res.length > 0){
                for(var i=0; i<res.length; i++){
                    for(var x=0; x<kriteria.length; x++){
                        if(res[i].kriteria_id == kriteria[x].id) {
                            elmDOM += '<td>'+ res[i].nilai +'</td>';
                            $.ajax({
                                method: 'post',
                                url: 'service.php?page=nilai&action=getNilaiTotalByKategori',
                                async: false,
                                dataType: 'json',
                                data: {kriteria_id: res[i].kriteria_id},
                                success: function(resp) {
                                    var matriks = 0;
                                    if (resp.tipe == 'cost') {
                                        matriks = resp.nilai_min/res[i].nilai;
                                    } else {
                                        matriks = res[i].nilai/resp.nilai_max;
                                    }

                                    var persentasi = matriks*(res[i].bobot/sum);
                                    ranking += persentasi;
                                    matrikDOM += '<td>'+ matriks.toFixed(2) +'</td>';
                                    matrikBobotDOM += '<td>'+ persentasi.toFixed(2) +'</td>';
                                    updateMatrik(res[i].kriteria_id, sampel[j].id, matriks, persentasi);
                                }
                            });
                        }
```

Figures 4: SAW Algorithm Coding

## 4. Evaluation

The results of testing were conducted by comparing the manual calculations for specific input data with the recommendation results generated by the system. The testing showed that both methods produced the same results. Then, the system was evaluated by distributing questionnaires to 33 respondents. The questionnaires used a Likert scale with 5 types of responses to measure users' opinions about the recommendation system, which are strongly agree (SA), agree (A), neutral (N), disagree (D), and strongly disagree (SD). The questions asked were as follows:

1. “The user interface of the house rental recommendation system is easy to use." The results showed that 45.5% agreed, 30.3% strongly agreed, and 12.1% were neutral.
2. “The ranking results of house rentals by the recommendation system are in line with your needs." 51.5% of the respondents agreed, 24.2% strongly agreed, and 15.2% were neutral.
3. "Do you think the recommendation process is fast enough?" 45.5% of the respondents agreed, 27.3% strongly agreed, and 15.2% were neutral.
4. "The recommendation system can help you in choosing a house rental." 48.5% of the respondents agreed, 21.2% strongly agreed, 15.2% were neutral, and 9.1% disagreed.
5. "The recommendation system has an easy-to-understand interface." 48.5% of the respondents agreed, 24.2% strongly agreed, and 15.2% were neutral.

After interpreting the values for all the questions, the average value was calculated to obtain a total average of 76.18% agreement."

## 5. Discussion

The advantages of using the Simple Additive Weighting (SAW) method in a recommendation system for house rental selection are:

- SAW method is relatively simple and easy to implement, allowing for quick integration into the recommendation system. It does not require complex data processing or complicated algorithms, making it suitable for smaller scales or simple applications.
- The results of the SAW method can be easily interpreted, as it uses weights and criteria values that are understandable by users. This helps users understand and trust the recommendation results provided by the system.
- SAW method provides flexibility in determining criteria weights, which can be adjusted based on user or expert preferences. Users can assign different weights to each criterion according to their importance in decision-making, resulting in more personalized and user-specific recommendations.

However, there are several disadvantages to consider in using the SAW method in a recommendation system for house rental selection, including:

- Subjectivity in determining criteria weights in the SAW method, depending on user or expert preferences. This subjectivity can result in biased or non-objective recommendation results, depending on the weights assigned to each criterion.
- The SAW method does not consider interactions between criteria in decision-making. However, in house rental decision-making, there may be interactions between criteria, such as price and location influencing each other. The SAW method cannot accommodate these interactions, resulting in less accurate recommendations.
- The SAW method requires criteria data to be in the same scale, as it normalizes the data. If there are criteria with different scales, the recommendation results may be influenced by the data normalization used.
- The SAW method tends to not actively utilize user data in its calculations. It only focuses on weights and criterion values, without considering user preferences that may change over time.
- The SAW method may not be efficient in processing large or complex data. It may take a long time to process a large amount of complex house rental data, which can hinder the overall performance of the recommendation system.

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