

Implementation of Simple Additive Weighting on Decision Support System for Acoustic Guitar with Web-Based

(Study Case: Chaniago Sport)

Frans Imanuel¹, Fenina Adline Twince Tobing²

^{1,2}Program Studi Informatika, Fakultas Teknik dan Informatika Universitas Multimedia Nusantara, Tangerang, Banten, Indonesia

¹frans.immanuel@student.umn.ac.id

²fenina.tobing@umn.ac.id

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Abstract—The acoustic guitar is one of the most popular musical instruments because music itself is a universal language that everyone can understand. Acoustic guitars are available in many choices such as wood types, brands, prices, and many sizes. Many people who want to buy a guitar are often confused when they have to choose an acoustic guitar that suits their needs, this happens because there are many aspects of an acoustic guitar that must be considered as already mentioned. The demands of work and the busyness of today's society This makes many people unable to choose and see the acoustic guitar according to their needs in music stores. Therefore, this system was created as an acoustic guitar recommendation system, so that people can choose an acoustic guitar that suits their needs and buy an acoustic guitar online based on people's preferences. The recommendations given by this system are obtained from calculations using the simple additive weighting method or known as the weighted addition method. This simple additive weighting method has been tested in this study and can be implemented correctly and as needed. End-user satisfaction is also obtained using the end-user computing satisfaction (EUCS) method so that the recommendation system that has been successfully built can be said to be very good for users in providing acoustic guitar recommendations.

Key words — Acoustic Guitar, EUCS, SAW, Recommendation System, Web.

I. INTRODUCTION

The guitar is one of the many types of stringed instruments played by picking. The guitar consists of the main body parts and the neck as a place for the

strings to be attached generally six. Traditional guitar shaped of various types of wood and the strings they are made of of nylon or steel(string). In general, there are 2 types of guitars namely: acoustic and classical. The acoustic guitar is a guitar that part of the body is hollow / hollow (hollow body) and has used for a long time. Acoustic guitar is generally played as a solo instrument using a fingerstyle technique that comprehensive, but there are also people who play it together with other instruments because there is no patented way of playing an instrument such as a guitar acoustic tar, every acoustic guitar player has his choice each playing the guitar [1].

Choosing a quality acoustic guitar and in accordance with the wishes is not easy, especially for a beginner. Based on interviews with experts, namely Chanigao Sport. Chaniago Sport is a music shop that has been around since 2005, the shop sells acoustic guitar instruments, some guitar accessories and sells some sports equipment. Chaniago Sport is located in the Kutabumi area, Tangerang, Pasar Kemis, 15560. Based on interviews conducted with the Chaniago Sport music shop voters, the first problem that is often experienced by ordinary people in choosing an acoustic guitar lies in determining the needs for using the guitar, for example the criteria/aspects what is in the guitar, starting from the purchase price, type of wood, brand, size of the guitar and the necessary needs such as "Is the guitar used to learn to play guitar, whether to take it for recreation and become an entertainment musical instrument, and many more". Second, buyers are also

faced with many choices of acoustic guitars with various brands and shapes today. It is possible for a beginner to be able to search for information through the internet, or ask a more experienced acoustic guitar user directly. However, this is less efficient, because it takes a lot of time and money to get information about an acoustic guitar that suits your needs. [2]

Based on this background to reduce one's mistakes in choosing an acoustic guitar that is not in accordance with the wishes and needs, a Decision Support System (DSS) is needed using methods such as simple additive weighting. Based on previous research conducted by Ila Fitrotin Rosyidah and Agus Winarno [3], the reason for choosing the SAW method is because this method has advantages such as being easy to understand, more flexible, being able to solve complex problems and conducting learning based on human knowledge and experience in solving a problem.

Previous research conducted by Handayani, Rizki [4] also concluded that the *Simple Additive Weighting* (SAW) method is a method that can be used in decision support systems in various solutions to multi-criteria decision-making problems. this method can be dynamic in terms of criteria and preference weights in decision making so that the criteria and preference weights can be changed according to the provisions in the current developments.

The system that will be created is expected to provide convenience and be able to make guitar buyers more aware of their needs in choosing an acoustic guitar. This system aims to provide recommendations to users according to the desired needs. This decision support system is an application program that has been computerized to help prospective buyers to get a guitar that fits the required criteria. The user will select the desired criteria and the system will process it. Then based on the data that has been processed by the system, it will produce an output in the form of a conclusion what type of guitar is suitable and desired by the buyer.

II. LITERATURE REVIEW

System design begins with making a side application work flowchart normal users and admins, use case diagrams, followed by making ERD database, then wireframe the website view.

A. Use Case Diagram

Use Case Diagram is an image that represents the things an actor can do in completing a job.

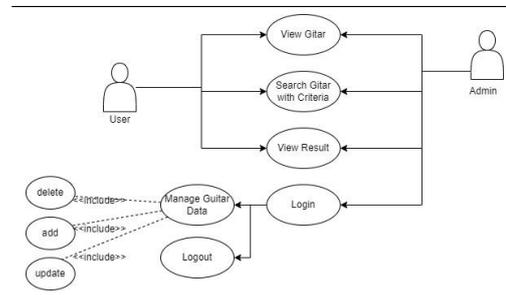


Fig. 1. Use Case Diagram

Figure 1 shows the use case diagram of a decision support system acoustic guitar selection. Users can view guitar data available on the system, search for guitars with the criteria that have been provided and see the results of recommendations both from all existing data and results based on the inputted criteria filters. The admin actor can login, make changes to guitar data in the database such as adding, changing certain guitar data and deleting data, then the admin can also log out from the admin page and the admin can also do all the things the user can do.

B. Data flow Diagram

Data Flow Diagram is a diagram that shows the flow and data relationships between each entity and existing processes. In this section, we will explain the Data Flow Diagram on the recommendation system for choosing an acoustic guitar in the Chaniago Sport case study. The process of presenting information will be simplified by using a simple visual display of data flow diagrams. The information provided can be used to describe the data flow. There are three levels of DFD in this study, namely DFD-Level 0 (Context Diagram), DFD-Level 1, and DFD-Level 2. The following is an explanation:

Figure 2 shows that there are 2 entities namely user and admin then there is 1 process, namely SAW Guitar, in this context diagram the user entity will send a guitar recommendation request to the SAW Guitar process and the process will return results in the form of guitar recommendations desired by the user, then on the right there is an admin entity that is useful for setting up existing guitar data. The SAW Guitar process is a Simple Additive Weighting method.

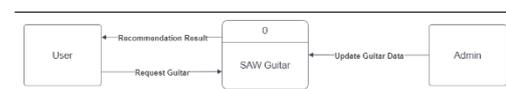


Fig. 2. Data Flow Diagram Level 0

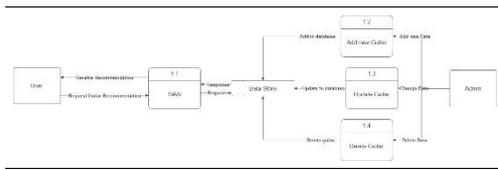


Fig. 3. Data Flow Diagram Level 1

Figure 3 contains the process of Add new guitar, update guitar, and delete guitar, each process is a process that can only be done by an admin entity that aims to manage guitar data in the existing database. The data in the database will be used to carry out the SAW guitar process so that users can get the results of current guitar recommendations.

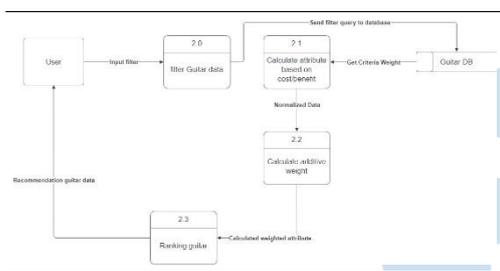


Fig. 4. Data Flow Diagram Level 2

Figure 4 here is explained in more detail about the SAW guitar process that occurs. Starting from the user who sends the desired guitar data filter process (in this process the user can also perform a filter without a specific filter which will make the data displayed is the data of all guitars owned). From the filter that has been determined, the guitar data filter process will generate a query into the database so that the normalized data is only the desired guitar data, from the normalization results obtained, the calculation of criteria based on attribute costs and benefits will be carried out in the calculate attribute based on cost process. benefit, the results that will be obtained in this process will be arranged to determine the existing guitar rankings to be given to the user.

C. Flowchart

Flowchart is a diagram that represents the workflow/process. Under these are flowcharts of each feature in the program. Program workflow made as short as possible with the aim that users can easily use and understand the program created.

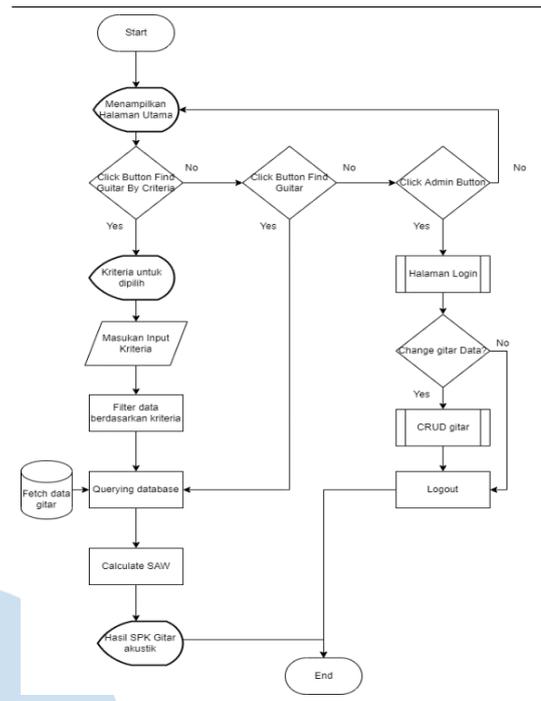


Fig. 5. Main Flowchart

Figure 5 shows the main flowchart of the acoustic guitar selection decision support system which describes the workflow of the entire program, this main flowchart is also a workflow for ordinary users or admin users. First of the program will display the main screen which will have 3 main buttons to carry out the next process, namely a button to go to the admin menu, a button to search for guitar recommendations based on filtered criteria and a button to search for guitar recommendations without filters. If the user selects the button to view guitar recommendations with a filter, the user will be taken to the next page, which is a page that shows the form to fill out the criteria that the user wants after the form is submitted, the filter will perform a query request based on the criteria entered and the Simple Additive Weighting calculation process will be done based on the data in the filter and then will be displayed on the next page.

If the user selects the button to search for a guitar without a filter, the user will be immediately taken to the results page obtained from all the data in the database and after that the Simple Additive Weighting calculation is performed and then displayed to the user.

The last button is a button for the admin, this button will take the user to the login page to be asked for a username and password, if the user has entered the username and password correctly then the user will

enter the admin dashboard where there can create, read, update, delete data guitars in the database.

D. ERD

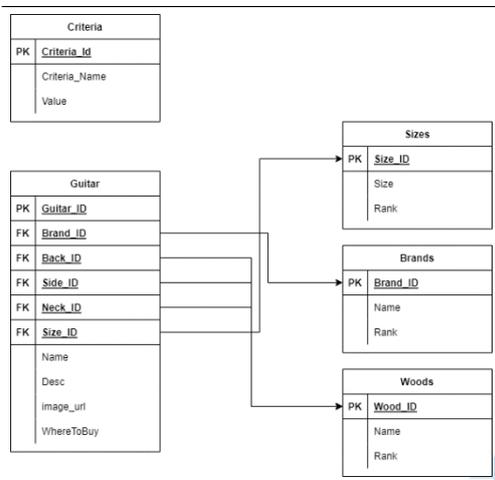


Fig. 6. Entity Relational Diagram

Figure 6 is an ERD image for the data in the database, first there is a Guitar table which has 5 foreign keys, namely Brand ID, Back ID, Side ID, Neck ID, Size ID. Brand ID refers to the Brands table, there is information about the existing guitar brands and the rating of each brand, then there are foreign keys Back ID, Side ID, Neck ID which point to the same table, namely the woods table, in the woods table there is information about the types of wood on the guitar and the rating of these woods, and the last is size ID in the size table there is information about the size of the guitar and the size rating. It should be noted here that Back, Side, Neck are the main woods that are often considered in buying guitars based on interviews with sources, therefore the three columns both refer to the woods table. The last one is the Criteria table, this table does not have any relation because this table was created only to store weight values for Simple Additive Weighting calculations in the future.

E. Wireframe

1) *Wireframe Landing Page*: Landing Page is the first page that will be seen by the user when the website is opened for the first time.



Fig. 7. Wireframe Landing Page

In figure 7 on this page, there are only 3 main buttons that will navigate the user to other pages, namely a button to view all guitar recommendations, a button to view guitar recommendations based on the selected filter and finally a button to enter the admin page.

2) *Wireframe Select criteria*: The select criteria page is a page to display the form to get the guitar criteria that the user wants then the results will be used as filters in the query to the database and the results will be calculated using the Simple Additive Weighting method. In figure 8 there are 4 inputfields to receive input from the user.



Fig. 8. Wireframe Page filter acoustic guitar

3) *Wireframe Recommendation Results*: The recommendation results page is a page that shows the results of the Simple Additive Weighting method either using the criteria selected by the user on the criteria select page or not.

Figure 9 shows that the guitar results displayed are in the form of cards that can be issued for more information about the guitar if clicked

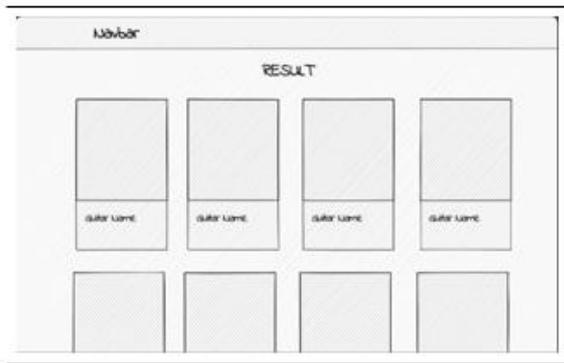


Fig. 9. Wireframe Page guitar results

4) *Wireframe Admin Page:* The admin page is there to manage guitar data in the database. Based on the 10-page figure, it has a table that contains information about the guitar and there are 2 buttons on the right, the button is a button to change data and delete data, while the button above is a button to add new guitar data. And there is a logout button in the navbar to logout as admin.

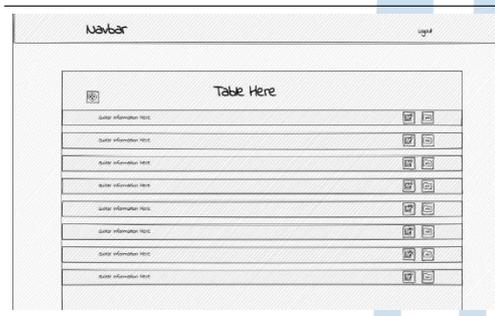


Fig. 10. Wireframe admin page

III. RESULTS AND DISCUSSION

Implementation is carried out based on use case diagrams, dfd, flowcharts, erd, and wireframes that have been made previously.

A. Website

1) *Landing Page:* Figure 11 is the result of the Landing Page implementation on an acoustic guitar purchase decision support system, on this page there are 4 buttons, a button to view guitar recommendations without a filter, a button to view guitar recommendations with a filter and in the navigation there is a button to go to the admin menu and to the website for writer information.



Fig. 11. Landing Page

2) *Page Filter Form Data Guitar:* Figure 12 is the result of the implementation of the page where to filter the data of the acoustic guitar purchasing decision support system. On this page the user will be asked to input to find out what kind of guitar criteria he wants, there are inputs to enter the desired guitar brand, the required price range, does the user care about the quality of the wood, does the user care about the size of the guitar, does the user care about the size of the guitar? the popularity of the acoustic guitar brand, does the user care about the price of the guitar. The series of questions in the filter form are obtained from the conclusions from interviews with experts, namely the owner of the Chaniago Sport music store and these questions are expected to be able to help the system to determine the acoustic guitar according to what the user wants.

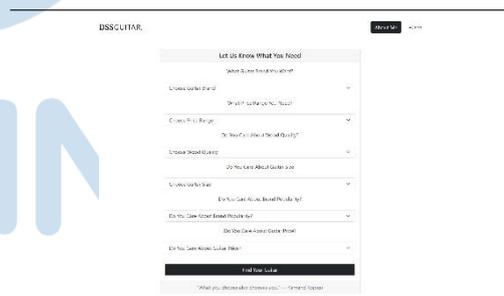


Fig. 12. Filter Form Guitar Page

Figure 13 is the validation result on the guitar form filter page if the user submits it without entering any input.

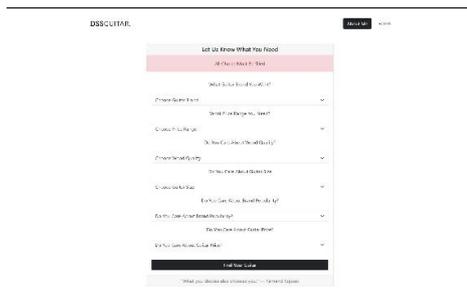


Fig. 13. Validation Filter Form Guitar

17 is the result of implementation for validation which is done if the username/password does not exist/wrong.



Fig. 16. Login Admin Page

3) *Guitar Recommended Results Page:* Figure 14 is the result of the implementation of the page where to display the recommendation results. On this page each guitar is displayed in the form of a card that will display a capital when clicked (figure 15), and in that modal there will be clearer information about the acoustic guitar such as price, brand, type of wood on the back, sides, neck, guitar size, description, and a link where to buy the guitar, at the very bottom there is also a pagination where to go to the next page.

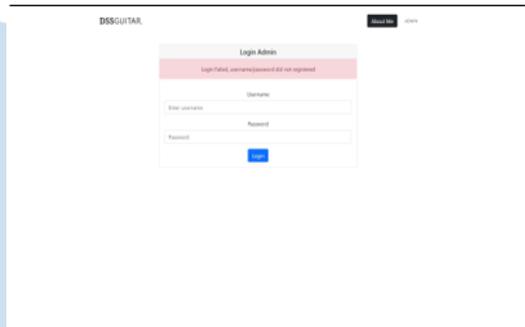


Fig. 17. Validation of recommendation results

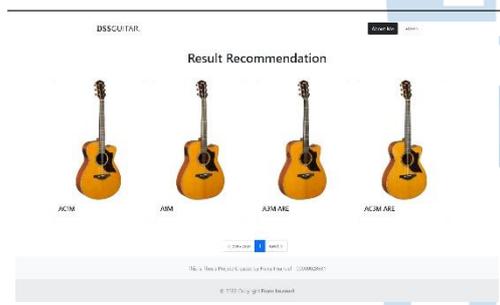


Fig. 14. Guitar Recommended Results Page

5) *Page Admin:* Figure 18 is the result of the implementation of the admin page, on this page the admin can view acoustic guitar details, can add acoustic guitar data, change existing data and delete data.

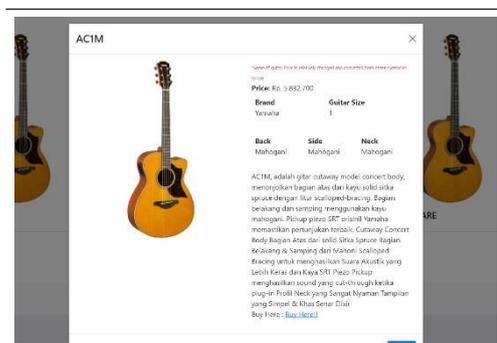


Fig. 15. Recommendation Result Modal

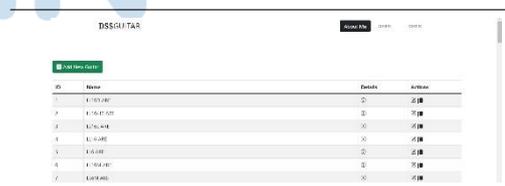


Fig. 18. Admin Page

4) *Login Admin Page:* Figure 16 is the result of the implementation for admin login, on this page there is a place to input username and password, and figure

6) **Guitar Data Detail View:** In figure 19 is a modal that shows details about the guitar when the details button (*i*) is clicked.

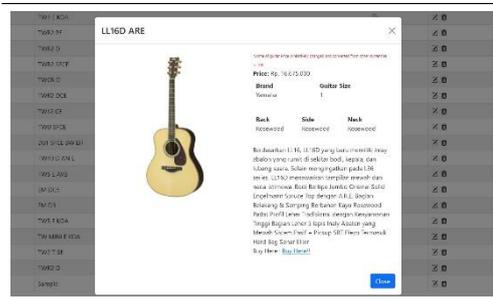


Fig. 19. Details Page

7) **Display Add Guitar Data:** In figure 20 and figure 21 are modals that are shown if the button to add data is clicked, this button will open a modal to enter new information that you want to add, such as the name of the acoustic guitar, the price of the acoustic guitar, the type of guitar brand, the size of the guitar, type of back, side and neck wood, image links, links to where to buy online, and descriptions of acoustic guitars. If the data entered is correct without any problems then an alert will appear as in figure 22, and if it fails an alert in figure 23 will appear.

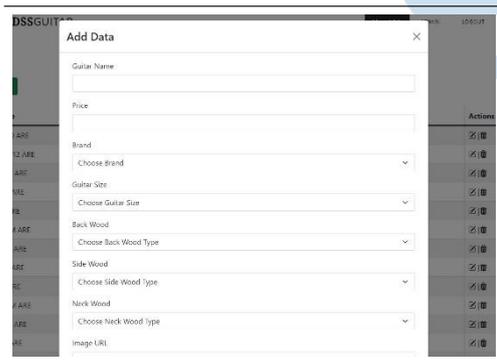


Fig. 20. Add Data Page 1

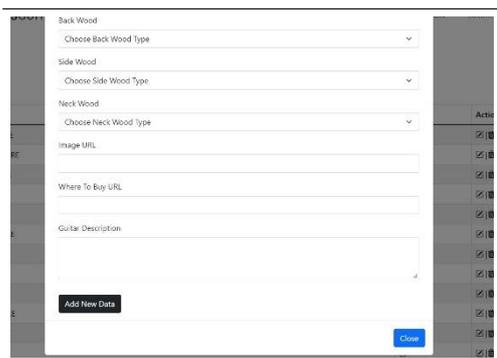


Fig. 21. Add Data Page 2



Fig. 22. Validation Successfully Added Data

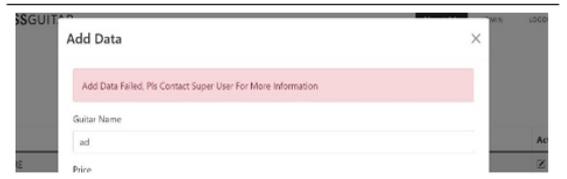


Fig. 23. Validation Failed Added Data

8) **Update Guitar Data View:** In figure 24 and figure 25 are modals that are shown if the button to change data is clicked, this button will open a modal to enter the information you want to change, such as the name of the acoustic guitar, the price of the acoustic guitar, the type of the guitar brand, the size of the guitar, the type of guitar. Wood back, sides and neck, image links, online purchase links, and acoustic guitar descriptions. If the changed data is correct without any problems, an alert will appear as shown in figure 26, and if it fails an alert in figure 27 will appear.

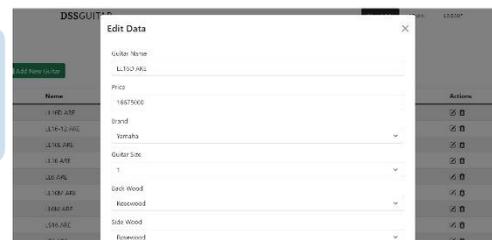


Fig. 24. Details Page 1

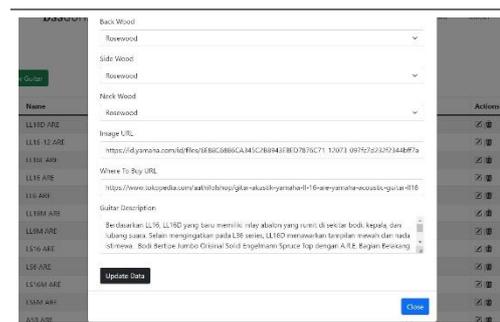


Fig. 25. Details Page 2



Fig. 26. Validation Successfully Added Data



Fig. 27. Validation Successfully Added Data

9) *Delete Guitar Data View:* In figure 28 is a modal that will appear if the delete button is clicked, this modal will display a question to the admin to ask if the admin is sure you want to delete the guitar data, and if the delete button is clicked then the next display is figure 29.



Fig. 28. Admin Page Delete Guitar



Fig. 29. Admin Page Delete Guitar Successfully

B. Simple Additive Weighting

The implementation of Simple Additive Weighting is done using the Go programming language, the following is a code snippet from the implementation. In figure 30 there is a function named SAW which accepts 3 inputs parameters and will produce 2 output parameters, the input parameter consists of guitars which is a data type struct which stores all information about the guitar that has been filtered based on the form that has been filled in by the user, the second is an instance pointer. To access the database and the third is the weight of the criteria that the user has selected in

the form. Whereas in the output parameter there is an array of struct Result which contains information about the guitar IDs that have become the final sorted result and finally there is an error, if there is an error, an error will return the error message, but if there is no error it will return nil (null in the golang programming language).

In the next line there is a variable declaration. The variable d is used to hold the smallest value for the cost attribute and the largest value for the benefit attribute, this is implemented in the previous line of code in the for-range loop below it. The variables n and ns are variables used to store the results of the normalized matrix, this is done at the bottom of figure 30, and the results and results variables are used to store the final results of the guitar ranking system. In the previous section, figure 30, it was explained how to implement Simple additive weighting to determine the divisor value for the cost, benefit and code attributes to get the matrix normalization results, then in figure 31 the code is used to get the weight value for each criterion from the database (if you don't do the filter process) / initialize the weight value obtained from the user if you use the available filters. The query process is carried out and the results obtained are stored in a folder with the name of each key and the name of the weight. And finally at the very bottom there is a for-range to determine the ranking results of previous acoustic guitars by multiplying the normalized matrix results and the weights obtained from the database/user input for each weight

```
func SAW(guitars []Model.Guitars, db *sql.DB, Weight Model.GuitarWeight)([]Model.Result, error){
    var d Model.Divider //d = divisor (percentage)
    var n Model.Divider //normalization
    var ns []Model.Divider //normalization
    var result Model.Result
    var results []Model.Result

    //insert divider based on cost/benefit
    for , g := range guitars{
        if d.Price >= *g.Price || d.Price == 0 { d.Price = *g.Price }
        if d.Back <= *g.Back_ID || d.Back == 0 { d.Back = *g.Back_ID }
        if d.Side <= *g.Side_ID || d.Side == 0 { d.Side = *g.Side_ID }
        if d.Neck <= *g.Neck_ID || d.Neck == 0 { d.Neck = *g.Neck_ID }
        if d.Size <= *g.GuitarSize || d.Size == 0 { d.Size = *g.GuitarSize }
        if d.Brand <= *g.Brand || d.Brand == 0 { d.Brand = *g.Brand }
    }

    //c = calculate
    for _ , c := range guitars{
        n.Guitar_ID = *c.Guitar_ID
        n.Price = d.Price / *c.Price
        n.Back = *c.Back_ID / d.Back
        n.Side = *c.Side_ID / d.Side
        n.Neck = *c.Neck_ID / d.Neck
        n.Size = *c.GuitarSize / d.Size
        n.Brand = *c.Brand / d.Brand
        ns = append(ns, n)
    }
}
```

Fig. 30. Code Snippets simple additive weighting 1

```

// Simple Additive Weighting
// Input: array of guitar objects
// Output: array of guitar objects sorted by rating

function simpleAdditiveWeighting(guitars) {
    // Calculate the rating for each guitar
    for (let i = 0; i < guitars.length; i++) {
        guitars[i].rating = (guitars[i].price * 0.3) +
            (guitars[i].back * 0.2) +
            (guitars[i].side * 0.2) +
            (guitars[i].size * 0.2) +
            (guitars[i].brand * 0.1);
    }

    // Sort the guitars by rating
    guitars.sort((a, b) => b.rating - a.rating);

    return guitars;
}

```

Fig. 31. Code Snippets simple additive weighting 2

Finally, in figure 32, the sorting process is carried out on the value whose result is larger to the smaller one and then returns.

```

for (let i = 0; i < results.length; i++) {
    result.guitar_id = results[i].guitar_id;
    result.rating = (results[i].price * cm["price"]) +
        (results[i].back * cm["back"]) +
        (results[i].side * cm["side"]) +
        (results[i].size * cm["size"]) +
        (results[i].brand * cm["brand"]);
    results = append(results, result);
}

// Sorting rating
sort.SliceStable(results, func(i, j int) bool {
    return results[i].rating > results[j].rating;
});

return results;

```

Fig. 32. Code Snippets simple additive weighting 3

IV. EVALUATION

The evaluation was carried out by distributing questionnaires to 32 respondents using the EUCS model and the Likert scale. After getting the results of the index for each EUCS component, the calculation of the success of the system is carried out. The following is the calculation of system success:

System Success Rate:

$$\begin{aligned}
 \text{Hasil} &= \frac{85.625 + 84.6875 + 86.25 + 85.3125 + 85.3125}{5} \\
 &= 85.4375 \Rightarrow 85\%
 \end{aligned}$$

From these results it can be concluded that the respondents strongly agree that the acoustic guitar recommendation system has been successful in recommending an acoustic guitar.

IV. CONCLUSION

Based on the research that has been successfully carried out, there are several suggestions from researchers that can be used as a reference or reference in the development of an acoustic guitar recommendation

system that has been successfully designed and built as well as for further research. The suggestions described are as follows.

1. This research can be developed by implementing other methods such as the AHP method, TOPSIS, weighted product, and others, so that the approach taken for further research can be different
2. The addition of other criteria to add to the consideration of this recommendation system, for example the appropriate brand of guitar strings and others
3. Based on the suggestions obtained in the guitar recommendation system questionnaire, it would be better if it had additional guitar brands with affordable entry levels or case studies of other music stores that had local guitars such as Mandalika, Cowboy, GL, Taylor, Cort, and others were added

The recommendation system about guitars can also be made wider, such as combining acoustic guitar topics with other guitars such as the ukulele/electric.

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