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Simple Additive Weighting algorithm to aid administrator decision making of the underprivileged scholarship

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Abstract. Underprivileged scholarships are assistance provided by government or institutions to students from poor families. Scholarships can be given to all students at the education level from elementary school to higher education with certain conditions and criteria. However, in reality many scholarships are given that are not on target. This is because of the number of students who register as scholarship recipients. Therefore, it is necessary to have a decision support system in order to aid the selection process. This study aims to find appropriate system to aid the underprivileged scholarship selection. This study proposed a system which was built using PHP for programming languages and using MySQL as its database using the Simple Additive Weighting method. Data is taken from SMK Sultan Agung 1 Jombang. Data is then analyzed and tested using the Blackbox testing method. Results of this research obtained a list of the best ranks of prospective scholarship recipients which are result of processing from system. The results obtained from system will be validated by means of comparisons with manual calculations as in Table 1. The validation results show same results, so that system can be said to be valid and can replace process that is done manually.

22 1. Introduction

The development of highly advanced information technology has provided a very important role in helping people carry out all activities, both in terms of employment, education and in making decisions. Along with the development of technology, the use of information systems is a matter that is felt to be very vital. Information system is a system that presents information that is useful for recipients or users for planning, controlling, and managing company organization decision making [1]. The system evaluation method was added to ensure and assess the system directly as intended or desired [2]. In this study the black box method was chosen to evaluate the system being built. The use of computer devices is also related to current technological developments. There are so many things that can be done by utilizing technological advances in computer devices. One of the implementations of advanced technological developments today is that it can assist in giving advice and determining a decision, one of which is to determine the eligibility of prospective scholarship recipients [3]. In determining the eligibility of prospective scholarship recipients is not an easy matter, the selection committee has difficulty because scholarships have increased from year to year and quotas remain limited [4]. There are criteria that affect the results of the selection, among others, the number of dependents of parents, parents' income, achievement (academic / non-academic), activity, and ownership of the card.

Scholarships are assistance provided by government institutions, companies or foundations. Granting this scholarship aims to ease the burden of underprivileged students so they can continue their education



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[5]. Scholarships are not only for underprivileged students; scholarships are often intended to reward students who excel in being more passionate about taking education. One school in Jombang that holds scholarships for students of Sultan Agung Vocational School 1. This school has several scholarships that can help reduce the cost of education. Submission [17] the Sultan Agung 1 Vocational School Scholarship which is very much often requires more time to determine students who are truly eligible to receive a scholarship. Especially for underprivileged scholarships, the scholarship [18] organizer must select all the data of underprivileged students with various predetermined criteria. Thus a system is needed that can help deal with these problems quickly and precisely so as to facilitate scholarship providers in making decisions for prospective scholarship recipients less capable.

The [14] method used in determining this scholarship is using Simple Additive Weighting. This method is used because it can determine the weight value of each attribute that will be carried out ranking process from the many alternatives and select the alternative to produce the best alternative [6]. The SAW method requires the process of normalizing the decision matrix (X) with a scale that can be compared with all the ratings of the alternatives. In the decision making process that is most widely used by researchers, because it is centered on a weighted sum that will be ranked according to the highest number [7]. The alternative referred to here is the prospective student scholarship recipient. Based on these problems, the author made a study entitled "Decision Support System for Prospective Recipients of Less Capable Scholarships at Sultan Agung 1 Vocational School using the Simple Additive Weighting Method" [8].

2. Method

The method used by the author to [15] perform data processing students who are prospective scholarship recipients is less capable of using the Simple Additive Weighting method. This method is often known as the weighted sum method.

2.1. Research design

The author makes a system [24] design that includes making Flowcharts and Data Flow Diagrams (DFD). The purpose of the design of this system is to create a decision support system design for disadvantaged scholarship recipients in SMK Sultan Agung 1 Jombang. The following is the design of the system.

2.1.1. Flowchart sistem. This flowchart describes the process carried out by the user in running the system. The flowchart starts when the user enters a username and password which will then be checked by the system, whether the username entered is appropriate or not. If it doesn't match, the system will display a warning to enter the correct username and password. If it is appropriate, then the user will be redirected to the main page, namely alternative data. The user will then enter alternative data, criteria, set of criteria, and classification of student groups [12]s. Then the user can do ranking with SAW calculation on the ranking analysis menu. Here is a decision support system [16] flowchart for underprivileged scholarship recipients at Sultan Agung 1 Jombang Vocational School can be seen in figure 1.

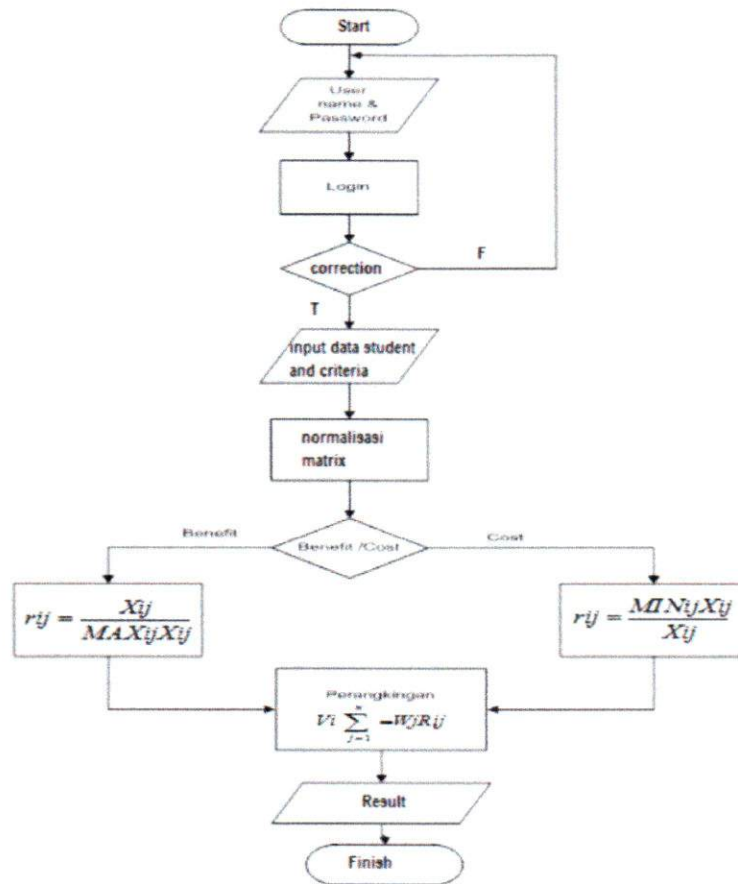


Figure 1. Flowchart system.

2.1.2. Context diagram. Fig. 2 is a context diagram contains a description of the system that will be created by the author, which includes who are the entities involved in the system, and what data is entered into the system that will be created. The results obtained from the system calculation will be shown to the Scholarship Coordinator and the Principal. The data shown is in the form of proposals for prospective scholarship recipients who are truly eligible to receive scholarships.

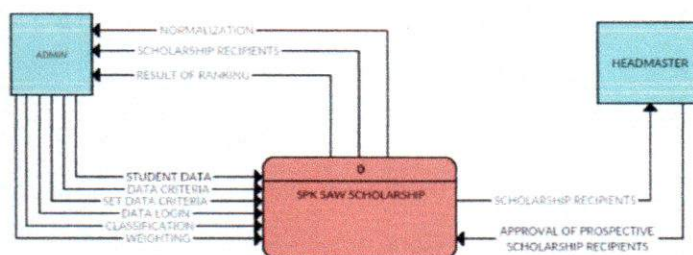


Figure 2. Context diagram.

2.1.3. DFD. This diagram describes what processes are in the system that will be created. This process includes logins, alternative inputs, input criteria, input classifications and ranking. Next is the DFD decision support system for underprivileged scholarship recipients can be seen in Fig. 3.

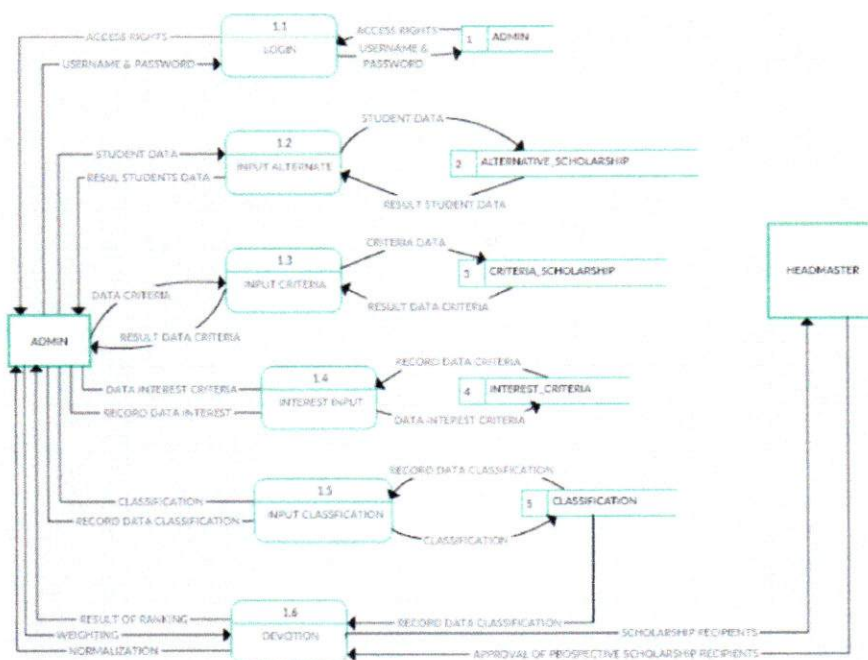


Figure 3. DFD.

2.2. Population and sample

The population and sample used in this study is to use data from the students of Sultan Agung Vocational High School 1. The data is in the form of names and criteria data from Sultan Agung 1 Vocational School students.

2.3. Data collection techniques

The techniques used in data collection by the author are interviews, observation, and literature studies. Interviews were conducted with the organizers of the scholarship and asked for each criterion that would be used as a reference in determining students who were truly eligible to receive scholarships at Sultan Agung Vocational High School 1. This technique was most effective in seeking information from disadvantaged scholarship students.

2.4. Data analysis techniques

The author chooses the Simple Additive Weighting method in this study, where this method is centered on weighted summation which will be ranked according to the highest number [9]. This ranking will later become the best alternative in determining students who are less capable scholarship recipients [10]. The solution is:

- 1) Determine the criteria that will be used as a reference in decision making.
- 2) Determine the suitability rating of each alternative on each criterion.

- 3) Make a decision matrix based on the criteria, then normalize the matrix based on the equations that are adjusted to the type of attributes, namely the benefits and cost attributes so that the normalized matrix can be obtained.

For benefit attributes, use the formula:

$$r_{ij} = \frac{X_{ij}}{\text{MAX}_{ij} X_{ij}} \quad (1)$$

For the cost attribute, use the formula:

$$r_{ij} = \frac{\text{MIN}_{ij} X_{ij}}{X_{ij}} \quad (2)$$

Information:

r_{ij} = The performance rating is normalized

MAX_{ij} = The maximum value of each row and column

MIN_{ij} = Minimum value for each row and column

X_{ij} = row and column of the matrix

Benefit = The biggest value is the best

8 Cost = The smallest value is the best

- 4) The final results are obtained from the ranking process, namely the sum of normalized matrix multiplications with weight vectors so that the largest value is selected as the best alternative for underprivileged scholarship recipients.

$$V_i = \sum_{ij}^n W_j r_{ij} \quad (3)$$

10 Information:

V_i = The final value of the alternative

W_j = predetermined weight

R_{ij} = Normalization of the matrix

3. Results and discussion

The results obtained after conducting this research will be elaborated from each program display form along with the functions of the form.

3.1. Form login

This form is the initial display 18 when opening a decision support system for prospective scholarship recipients. Users are required to enter the appropriate username and password in order to enter the system.

3.2. Form alternatif

This form has several functions including entering alternative data of prospective scholarship recipients into the database and displaying it into a datatable, editing alternative data, deleting alternative data, and being able to search for alternative data.

3.3. Form criteria

This form has several functions, which are inputting criteria data, editing criteria data, deleting criteria data, and searching criteria data. 20 The criteria used in determining the prospective student recipients are five, namely the number of dependents of parents, parents' income, achievements (academic and non-academic), activity, and ownership of the card.

3.4. Set form

This form has several functions, namely inputting assessment data on each predetermined criteria along with information on each assessment. This form can edit set criteria data, delete criteria set data, and can search criteria set data.

3.5. Classification form

This form serves to classify each alternative, criteria, and set of criteria. Data that has been entered into the classification form will be used to carry out the normalization and ranking process.

3.6. Ranking analysis form

This form displays the results of analysis of prospective scholarship recipients, starting from determining the value of weight, the process of normalization, to the ranking process of students. The form ranks the best alternative candidates for the scholarship based on the highest score.

3.7. Comparison of calculation results

Comparison results are the results obtained by the system compared to the results of manual calculations. The following results from the comparison shown in table 1.

Based on table 1, there are results of a comparison between system usage and manual workmanship. From the 10 data used the comparison can be found to get the same value. For example data with the name of affandi faris, based on old calculations with manual calculations get a value of 0.63 and compared to the calculation of the system get a value of 0.63. So the results of the system calculation can be said to be valid and can be feasible to replace the process carried out manually.

Table 1. Comparison results.

| Name | P.Manual | P.Sistem |
|------------------------|----------|----------|
| Muhammad Yusuf Afandi | 0.78 | 0.78 |
| Muhammad Riski Utomo | 0.71 | 0.71 |
| Dhitok Kusbianto | 0.66 | 0.66 |
| Achmad Nur Faizin | 0.65 | 0.65 |
| Maulana Romadhon | 0.65 | 0.65 |
| Muhammad Dwiky Wahyudi | 0.64 | 0.64 |
| Shoqibul Humam | 0.64 | 0.64 |
| Yuda Iswantoro | 0.64 | 0.64 |
| Faris Affandi | 0.63 | 0.63 |
| Rudy Hansyah | 0.63 | 0.63 |

4. Conclusion

Based on the research results of the author entitled **Decision support system** for underprivileged scholarship recipients at SMK Sultan Agung I using the Simple Additive Weighting method. Resulting system can help scholarship coordinators in determining prospective scholarship recipients by calculating the value of each alternative scholarship recipient. Implementation of the system is done by entering data on prospective scholarship students, scholarship criteria, set of criteria obtained by each alternative. The ranking results obtained are based on the criteria obtained by each student. The system can speed up decision making by displaying ranking tables based on students who get the highest score up to the lowest value.

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