

Decision Support System for Specialization Selection Based on Student Interests and Abilities Using the Weighted Product Method

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Abstract

This research was developed to provide a more efficient and accurate solution in assisting the process of selecting student specializations. This research aims to help schools determine whether or not specializations are appropriate for students. The method used in this research is the Weighted Product (WP) Method. This method was chosen because it is capable of solving multi-criteria problems and providing specialization recommendations based on accurate criteria weight calculations. Next, the data that has been collected will be entered into a decision support system that has been created using the Weighted Product method. This Decision Support System will calculate the weight scores and criteria that have been determined. It is hoped that the results of this research can help schools provide specialization options that suit students' interests and abilities. The application test results and questionnaire test results are categorized as feasible based on the research success table and implementation. This decision support system application shows that this application runs well through functional testing and produces the expected output.

Keywords: Queuing Applications, Client Server, SDLC Prototype Model.

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Introduction

The choice of specialization in high school education is currently experiencing significant changes in terms of the curriculum (Aryanto et al., 2022). Previously, specialization selection was carried out when new students entered school or at the registration stage for new students (SMAN1Tumpang, 2019). However, with the change from the 2013 curriculum to the independent curriculum, the specialization selection process has also changed (Fitri, 2021). In the independent curriculum, selecting specializations is no longer carried out at the start of high school but is moved to the stage where students will enter class XI. This aims to give students more time to consider their interests, talents, and potential before choosing a suitable specialization (Solichin, 2016). This change benefits students, as they have more opportunities to become familiar with various subjects and get a clearer picture of their interests and abilities as they progress through high school (Syaukani, 2005). This change also requires a more active role from schools and teachers in providing information, guidance, and counseling to students to help them select their specialization.

Choosing the right specialization is crucial in planning a student's career (Sobari, 2019). When students choose a specialization that suits their desires, it can help them achieve their best potential, and motivate them in the learning process. On the other hand, students who choose their specialization randomly due to pressure from other people such as friends, parents, or because they don't like the subject teacher, will have a different learning experience. The process of selecting student specializations is currently still done manually by comparing students' scores. However, in carrying out this process obstacles often arise. One of them is the increase in the number of students from year to year, which makes the process of determining specialization more complicated. Apart from that, many criteria must be considered in determining a student's specialization (Silitonga et al., 2023). These obstacles can hurt the calculation process so that the results obtained are not objective. This can result in an imbalance in the distribution of students to various specializations, so that some students may not be suited to their chosen specialization or unable to optimize their potential. In facing these obstacles, it is necessary to consider adopting a more efficient and objective method or system in the process of selecting student specializations.

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Research on specialization selection has also been carried out (Iskandar, Kartowagiran, et al., 2023) using the Weighted Product method. In this research, researchers focused on selecting specializations for the Mathematics and Natural Sciences (MIA) department and the Social Sciences (IIS) department (Nur et al., 2020). The criteria used in this research include National Examination (UN) scores, psychological tests, non-academic achievements and student interests (Awaliyah et al., 2020; Nadmilail et al., 2022). The results of this research show that the system developed is able to provide accurate and fast information regarding specialization at SMA Negeri 1 Purwodadi Grobogan. The Weighted Product method is used to combine the weight or importance of each criterion used in selecting specializations (Burstein & Holsapple, 2008; Rifqi & others, 2020). In this way, students can obtain appropriate specialization recommendations based on their assessment of these criteria.

As for other research conducted by (I. M. Siregar, 2023) with the title "Decision Support System Determining The Best Customers Using The Weighted Product Method". This research overcomes the problems in the process of determining majors which is done manually, takes a lot of time, is ineffective and often involves errors (Hermawan, 2021). To overcome this problem, the researchers designed, built and implemented a system designed using the Weighted Product method. This method is used to make it easier to select a major by giving weight to each relevant criterion (Sari, 2018).

In the context of SMA Negeri 1 Pangkep, it is necessary to transition from manual methods to digital systems in the majoring process. Manual methods that are less practical, ineffective and prone to errors can have an impact on students' choice of specialization and their learning process (Ariebowo & Widayanti, 2017). Therefore, as a solution to this problem, the author designed a specialization selection application (Afriyani & Rohman, 2022). This application aims to provide a more efficient and accurate solution in the specialization selection process for students (Anamisa & Mufarroha, 2022). With this application, students can be assured of easy and efficient access to the necessary information, as well as selecting specializations based on relevant criteria (Gusti et al., 2016; Solichin, 2016). Using applications in the specialization selection process will provide benefits, such as reducing the risk of calculation errors, speeding up the data processing process, and providing more objective specialization recommendations based on the data that has been collected (Muslihudin & others, 2016; Sarwandi et al., 2023).

In this way, students will get more accurate specialization results according to their interests, talents and potential (Rizka, 2023; Yudha, 2023). By designing a specialization selection application, it is hoped that the specialization selection process at SMA Negeri 1 Pangkep can be more efficient, practical, and can support students in making the right decisions regarding their specialization (Gede Iwan Sudipa et al., 2023). With this research, the author hopes to provide an effective and practical solution in the process of selecting student specializations at SMA Negeri 1 Pangkep, as well as helping students determine the right specialization according to their abilities and interests.

Method

This method section explains how research on the Decision Support System for Specialization Selection Based on Student Interests and Abilities Using the Weighted Product Method was carried out, namely:

1. Data Collection Stage

The data collection methods used in this research are:

a. Interview

An interview is an activity of asking questions and answering or asking questions directly to the Principal, teachers or staff of SMA Negeri 1 Pangkep to obtain accurate and reliable information (N. S. S. Siregar, 2002).

b. Observation

Observation is the activity of observing directly by conducting inspections and recording directly at the Pangkep 1 Public High School to receive the necessary information.

c. Literature review

Literature study is a step in research that involves exploration, collection and analysis of literature or library sources related to the research topic (Adlini et al., 2022). For example, searching for and reading various types of literature sources, including scientific journals, books, articles, theses and reports that are relevant to the research topic.

2. Requirements Analysis Techniques

Needs analysis is a process carried out to identify, understand and define needs or conditions that must be met by a system or solution in selecting specializations that suit students' talents and abilities.

a. Software Requirements

- 1) Windows 10 OS
- 2) Google chrome
- 3) XAMPP
- 4) VsCode

b. Hardware Requirements

- 1) Memory (RAM) 4GB / Hard disk 500 GB
- 2) Processor with Intel (R) Celeron (R) CPUN3060@ 1.60GHz specifications

3. System Design Methods

The essence of the goal of system design is to present an overview of the system design that will be used or developed, as well as gaining a better understanding of the flow of information and processes in the system (Iskandar, Fitriani, et al., 2023). This design uses a use case which describes two entities, namely admin and students, each process that will occur is explained in an activity diagram (Kurniawan, 2018).

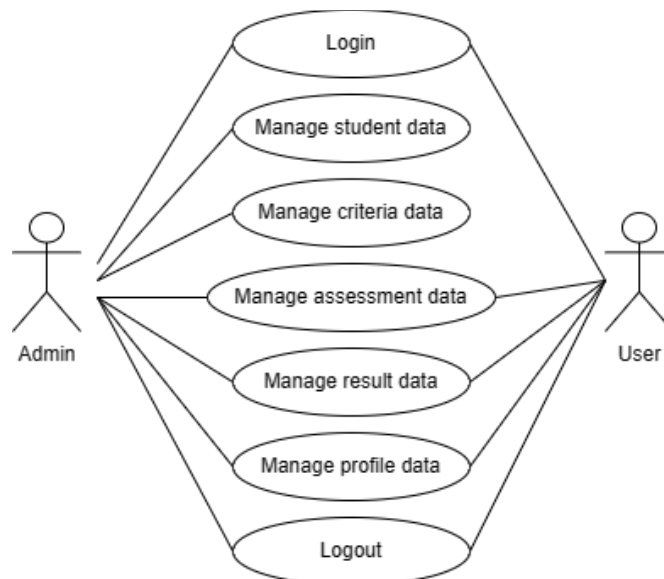


Figure 1. Use Case Diagram

4. Class Diagrams

Class diagrams are a type of diagram that is very useful in UML because they are able to clearly describe the layout of a particular system through modeling classes, operations, attributes and relationships between objects (Setiawan Rony, 2021). This class diagram illustrates the interactions between relations in the system.

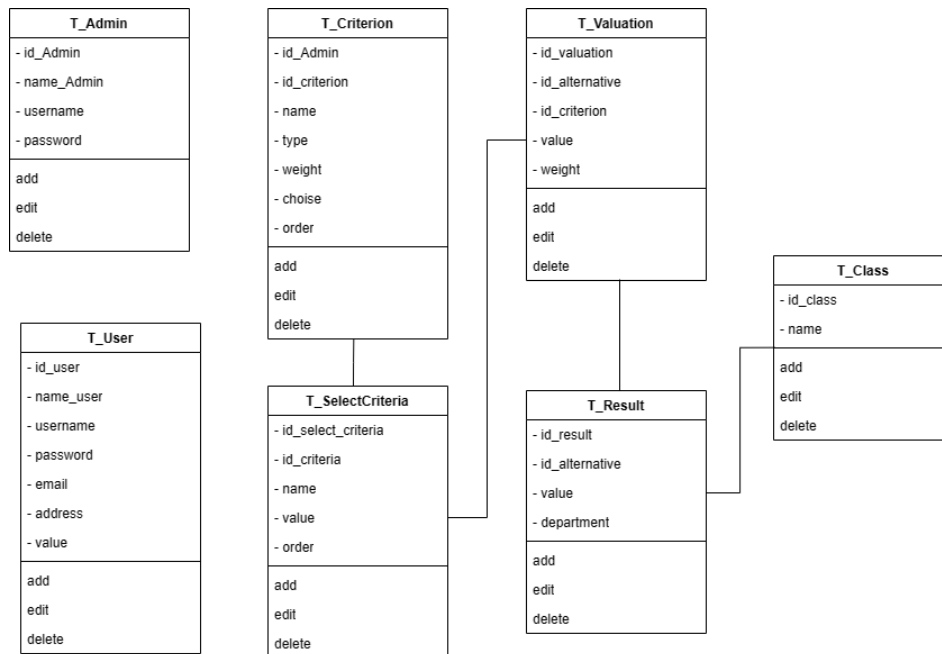


Figure 2. Class Diagram

Results and Discussion

Results

The results of research from the Decision Support System for Selecting Specializations Based on Student Interests and Abilities Using the Weighted Product Method are as follows:

1. Blackbox Texting Testing

This testing is carried out with the aim of ensuring that the system as a whole can operate properly and provide the expected results regardless of its internal implementation (Kurniawan, 2018), appears in the Table 1.

Table 1. Blackbox Texting Testing

Inputs	Function	Outputs	Results
Login Page	Displays the username and password page	Bring up the login page by entering the user name and password.	Succeed
Admin Main Page	Displays the main admin page	Brings up a page containing a dashboard, criteria data, student data, assessment data, calculation results data, and admin data.	Succeed
Criteria Data Page	Displays the criteria data page	Brings up a table containing NISN, student name, class, gender, and description.	Succeed
Student Data Page	Displays the student data page	Displays a table containing the criteria code, criteria name, type, weight, sequence, scoring method and description.	Succeed
Assessment Data Page	Displays the assessment data page	Brings up a table containing the name and description	Succeed
Calculation Results Data Page	Displays the calculation results data page	Brings up a table containing alternative results, class, S value, V value and information.	Succeed
Inputs	Function	Outputs	Results
User Home Page	Displays the user's main page	Brings up a page containing the dashboard, calculation data and admin data	Succeed
Results Data Page	Displays the results data page	Displays a table containing NISN, student name, grades and specialization recommendations.	Succeed
Profile Data Page	Displays the profile data page	Displays a page containing profile data from the user.	Succeed

2. Implementation of the Weighted Product Method

In testing this calculation, it will be carried out on alternative data and criteria that have been input by the user(Sahara et al., 2022), appears in the Table 2-5.

a. Alternative Data

Table 2. Alternative Data

Code	Alternative
A01	Riska
A02	Fera
A03	Hero

b. Criterion Data

Table 3. Criteria Data

Preference Weights			
Criteria Code	Criterion Name	Type	Weight(W)
C01	Mathematics	10	0.1
C02	English	10	0.1
C03	ICT	10	0.1
C04	Economy	10	0.1
C05	Chemistry	9	0.09
C06	Indonesian	9	0.09
C07	Geographical	9	0.09
C08	Physics	6	0.06
C09	Arabic	6	0.06
C10	Sociology	6	0.06
C11	Biology	5	0.05
C12	German language	5	0.05
C13	Anthropology	5	0.05

c. Criteria Assessment

Table 4. Assessment Criteria

Subject Values	Category	Mark
87-100	Very high	1
73-86	High enough	0.8
59-72	Tall	0.6
45-58	Fairly Low	0.4
31-44	Low	0.2
<30	Very low	0

d. Entering Criteria Values

Table 5. Entering Criteria Values

Specialization Selection Decision Support													
AIR CONDITIONING	C01	C02	C03	C04	C05	C06	C07	C08	C09	C10	C11	C12	C13
A01	74	60	77	80	57	79	88	74	60	77	80	57	79
A02	48	50	65	85	77	66	50	48	50	65	85	77	66
A03	77	92	80	77	85	76	80	77	92	80	77	85	76

e. Weight Normalization

$$W = 5, 5, 5, 5, 4, 4, 4, 3, 3, 3, 2, 2, 2$$

$$W_1 = \frac{5}{5+5+5+5+4+4+4+3+3+3+2+2+2} = \frac{5}{47} = 0.106$$

$$W_2 = \frac{5}{5+5+5+5+4+4+4+3+3+3+2+2+2} = \frac{5}{47} = 0.106$$

$$W_3 = \frac{5}{5+5+5+5+4+4+4+3+3+3+2+2+2} = \frac{5}{47} = 0.106$$

$$W_4 = \frac{5}{5+5+5+5+4+4+4+3+3+3+2+2+2} = \frac{5}{47} = 0.106$$

$$\begin{aligned}
 W_5 &= \frac{4}{5+5+5+5+4+4+4+4+3+3+3+2+2+2} = \frac{4}{47} = 0.085 \\
 W_6 &= \frac{4}{5+5+5+5+4+4+4+4+3+3+3+2+2+2} = \frac{4}{47} = 0.085 \\
 W_7 &= \frac{4}{5+5+5+5+4+4+4+4+3+3+3+2+2+2} = \frac{4}{47} = 0.085 \\
 W_8 &= \frac{3}{5+5+5+5+4+4+4+4+3+3+3+2+2+2} = \frac{3}{47} = 0.064 \\
 W_9 &= \frac{3}{5+5+5+5+4+4+4+4+3+3+3+2+2+2} = \frac{3}{47} = 0.064 \\
 W_{10} &= \frac{3}{5+5+5+5+4+4+4+4+3+3+3+2+2+2} = \frac{3}{47} = 0.064 \\
 W_{11} &= \frac{2}{5+5+5+5+4+4+4+4+3+3+3+2+2+2} = \frac{2}{47} = 0.043 \\
 W_{12} &= \frac{2}{5+5+5+5+4+4+4+4+3+3+3+2+2+2} = \frac{2}{47} = 0.043 \\
 W_{13} &= \frac{2}{5+5+5+5+4+4+4+4+3+3+3+2+2+2} = \frac{2}{47} = 0.043
 \end{aligned}$$

f. Vector S Value

$$\begin{aligned}
 S_1 &= (74^{0,106})(60^{0,106})(77^{0,106})(80^{0,106})(57^{0,085})(79^{0,085})(88^{0,085}) \\
 &\quad (74^{0,064})(60^{0,064})(77^{0,064})(80^{0,043})(57^{0,043})(79^{0,043}) = 18,16 \\
 S_2 &= (48^{0,106})(50^{0,106})(65^{0,106})(85^{0,106})(77^{0,085})(66^{0,085})(50^{0,085}) \\
 &\quad (48^{0,064})(50^{0,064})(65^{0,064})(85^{0,043})(77^{0,043})(66^{0,043}) = 17,93 \\
 S_3 &= (77^{0,106})(92^{0,106})(80^{0,106})(77^{0,106})(85^{0,085})(76^{0,085})(80^{0,085}) \\
 &\quad (77^{0,064})(92^{0,064})(80^{0,064})(77^{0,043})(85^{0,043})(76^{0,043}) = 18,33
 \end{aligned}$$

g. V value

$$\begin{aligned}
 V1 &= \frac{18,16}{18,16+17,93+18,33} = 0,333 \\
 V2 &= \frac{17,93}{18,16+17,93+18,33} = 0,329 \\
 V3 &= \frac{18,33}{18,16+17,93+18,33} = 0,336
 \end{aligned}$$

3. System Implementation

a. Login Menu

The following image shows the login menu that can be used by admins and users to enter the system, by inputting the user name and password.



Figure 3. Login Menu

b. Admin Main Menu

The following image shows the main admin menu display if logged in as admin which displays the dashboard, criteria data, student data, assessment data, results data calculations, and admin data.

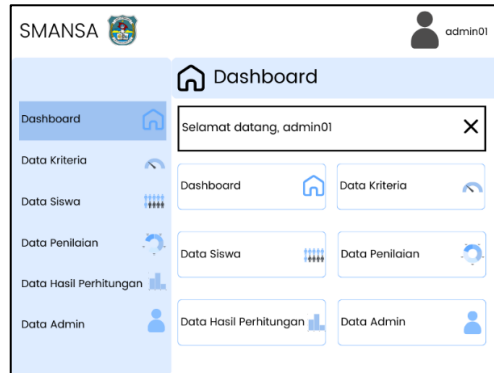


Figure 4. Admin Main Menu

c. Student Data Menu

The following image is a menu display to display student data.

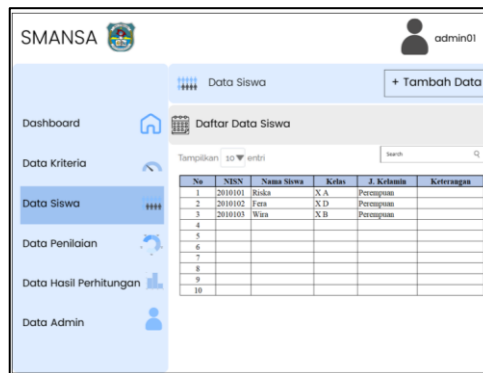


Figure 5. Student Data Menu

d. Criteria Data Menu

The following image is a display showing the criteria data.

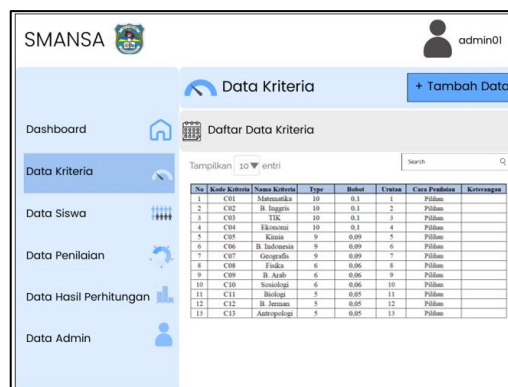


Figure 6. Criteria Data Menu

e. Assessment Data Menu

The following image is a display of the assessment data menu.

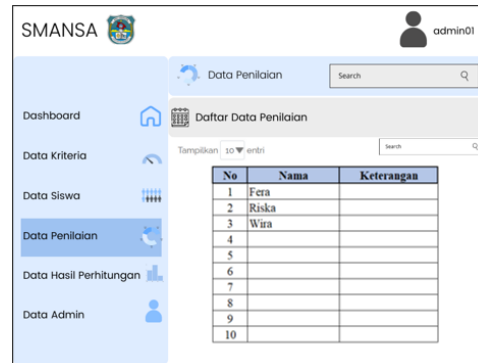


Figure 7. Assessment Data Menu

f. Calculation Results Data Menu

The following image is a menu display to show the calculation results of the weighted product method.

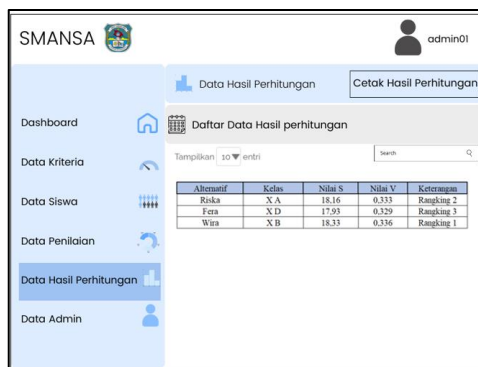


Figure 8. Calculation Results Data Menu

g. User Main Menu

The following image shows the dashboard menu display if logged in using a user account.

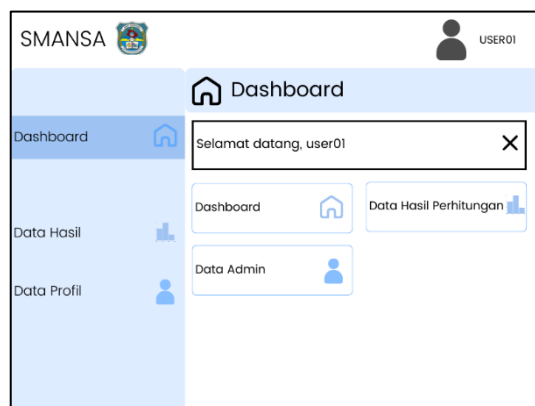


Figure 9. Main User Menu

h. User Results Data Menu

The following image is a display that shows the final results of the calculation and to get department recommendations.

No	NISN	Nama Siswa	Nilai	Rekomendasi Peminatan
1	2010101	Riska	0.333	MIPA
2	2010102	Fera	0.329	IPS
3	2010103	Wira	0.336	MIPA
4				
5				
6				
7				
8				
9				
10				

Figure 10. User Results Data Menu

i. Profile Data Menu

The following image is a menu display that shows user profile data

Field	Value
Nama	User01
NISN	202010
J. Kelamin	Perempuan
Tempat Lahir	Makassar
Tanggal Lahir	20022002
Alamat	Jl. Sultan Hasanuddin
Kelurahan	Tumampua
Kecamatan	Pangkajene
Kabupaten	Pangkajene
Provinsi	Sulawesi Selatan
No HP	6289564321334
Agama	Islam

Figure 11. Profile Data Menu

Discussion

Respondents' assessment regarding the decision support system for selecting specializations based on students' interests and abilities using the WP method with the available criteria. Each criterion is given weight according to its superiority. The questionnaire distributed included 30 respondents in Table 6.

Table 6. Respondents' Assessment

Question	Mark				
	SP (5)	P(4)	N(3)	TP (2)	STP (1)
Is the application easy to use?	22	6	2	0	0
Does the application output accurate data?	25	2	3	0	0
Does the application help the school in determining specialization?	27	0	3	0	0
Is the chosen specialization very important in choosing a college major?	23	5	2	0	0
Can this application speed up and simplify school education?	28	2	0	0	0
TOTAL	125	15	10	0	0

Information:

SP : Very satisfied
 P : Satisfied
 N : Neutral
 T.P : Not satisfied
 STP : Very Dissatisfied

The percentage can be done using a Likert Scale calculation as follows:

- Respondents with the number of very satisfied answers (5) = 125
- Respondents with the number of satisfied answers (4) = 15
- Respondents with neutral answers (3) = 10
- Respondents with the number of dissatisfied answers (2) = 0
- Respondents with the number of very dissatisfied answers (1) = 0

The formula for calculating the Likert scale is

Calculating the Likert scale = $T \times P_n$

Note: T = Total number of answers
 P_n = Choice of Likert score numbers

Calculating the Likert scale = $(125 \times 5) + (15 \times 4) + (10 \times 3) + (0 \times 2) + (0 \times 1)$
 = $625 + 60 + 30 + 0 + 0$
 = 715

Percentage calculation = $\frac{\text{Total skala likert}}{\text{Total skor maksimal}}$
 = $\frac{715}{70}$
 = 0.95 (95%)

Based on the questionnaire percentage analysis shown in table 4.6 above, and by paying attention to the steps that have been explained, the conclusion is that the decision support system for selecting specializations for students at SMA Negeri 1 Pangkep using the Weighted Product method obtained a total percentage value of 95%. Therefore, this system can be implemented.

Conclusions and Suggestions

Conclusions

From the results of data analysis and design of a decision support system for selecting specializations for SMA Negeri 1 Pangkep students using the Weighted Product method, it can be concluded that:

- The decision support system for selecting specializations for students at SMA Negeri 1 Pangkep using the Weighted Product method can be applied at the research site based on the results of the application test and questionnaire test results which are categorized as feasible based on the research success table.
- The implementation results of this application show that this application runs well through functional testing and produces the expected output.

Suggestions

Based on the research results above, there are several suggestions for further system development to be better:

- It is necessary to change the criteria so that the accuracy of decision making is more perfect.
- To make it easier to access, this Decision Support System program can be developed into an Android-based application.
- It is necessary to have security facilities to prevent disturbance or damage caused by irresponsible actions.

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