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Decision Support System for Students Final Project Title Acceptance at Ganesha Polytechnic Medan using Analytical Hierarchy Process (AHP) Method

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ABSTRACT

Many students are confused about determining the title that has been standardized by the head of study program. Is the title they are proposing relatively easy and in accordance with what is standardized by the head of study program or could it actually make things difficult for the student? The decision making system method used is Analytical Hierarchy Process (AHP) with the criteria of level of difficulty, reference source, number of similar titles and reference accreditation. The manufacturing stages carried out in this research used the waterfall and web-based method. Making this application uses data processing procedures, Data Flow Diagrams and MySql DBMS. The output of the research I have made is that it can make it easier for students to submit the title of their final assignment, making it easier for the head of study program to sort out whether the title that will be submitted by the student is in accordance with the standards set by the head of study program and can also assess at the same time whether the title is easy and suitable for use as a final assignment.

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1. INTRODUCTION

In digital era, industrial companies and educational institutions are increasingly implementing technological developments in their work systems and procedures[1]. Technology is increasingly being used to support the progress of a company or educational institution, both to facilitate work, evaluate work, and make good decisions through computer calculations so that it can become a reference for developing the company[2].

In utilizing technology as a decision-making system, many methods can be applied to obtain more effective and efficient decisions[3]. One of them is the Analytical Hierarchy Process (AHP) method. This method can calculate a decision quickly based on the required and previously determined criteria, thereby producing a good decision from several other options[4]. AHP is a structured method for simplifying complex decisions by breaking down problems into hierarchical levels and assigning weights to criteria through pairwise comparisons, enabling quantitative prioritization[5].

Many students are confused about determining the title that has been standardized by the head of study program[6]. Is the title they are proposing relatively easy and in accordance with the standards set by the head of study program or can it actually improve the student, making it easier for the head of study program to sort

out titles that will later be issued by students that are in accordance with the standards set by the head of study program[7].

This system will make it easier for students to submit the title of their final assignment so that the head of study program can see and assess whether the title is easy and suitable for use as a final assignment[8]. The research that has been carried out by previous researchers which can support the journal in choosing the title of this thesis is quoted from the journal[9]. Conduct research on decision-making systems in determining thesis title[10]. This makes it easier for students to determine a thesis title that suits the student's abilities, as well as an alternative for students to determine a title that suits their wishes and consider titles that suit the student's abilities [11].

2. METHOD

2.1. Type of Data

In conducting this research, researchers obtained data from the results of searching for references from theses, final assignments, books and journals related to this research. In making this research, researchers used two types of data, namely:

a. Primary data type, primary data is obtained by researchers directly from the object of research in the form of a brief history of the Medan Ganesha Polytechnic along with other information needed to support this research.
b. Types of secondary data, secondary data is obtained by researchers from other sources in the form of reports or publications. Secondary data is taken directly from the staffing section of the Medan Ganesha Polytechnic which is domiciled at Jl. Ar. Hakim No.193 B-C Medan such as employee assessment forms assessed by direct supervisors / work units.

2.2. Data Source

To collect data samples, certain methods are carried out in accordance with their objectives, the methods that will be used by the authors in the preparation of this study are as follows:

a. Field Research: In this study the authors collected data directly about the object of research or research location, namely the Medan Ganesha Polytechnic, while the field research conducted was:
    1) Interview: One way of collecting data is by conducting interviews, namely by asking the sources directly, in collecting through this interview stage the author asks directly to the Academic staff regarding the selection of the title of the student's final assignment which is carried out by the head of the study program.
    2) Physical Observation: Observation or physical observation is a method of collecting data by making direct observations of cases or obstacles that occur in the ongoing process of selecting the title of a student's final assignment at the Ganesha Polytechnic in Medan.
b. Lybray Research: The author conducts library research to obtain scientific materials that will be used as a basis for thinking in writing and analyzing existing problems.

2.3. Problem Topic Analysis

The Waterfall method is used in system development. In general, the steps of the Waterfall method are shown in the following figure:

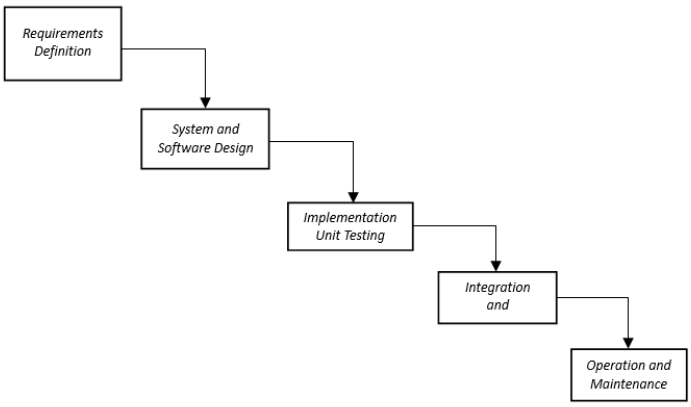

Figure 1. Waterfall Method

a. Requirements Definition: At this stage the system programmer requires communication aimed at understanding the software expected by the user and the limitations of the software. This data information is obtained through interviews, discussions or direct surveys at Medan Ganesha Polytechnic. The data is analyzed to provide the necessary information to the user.
b. System and Software Design: The requirement specifications from the previous stage will be studied in this phase and the system design is prepared. The system design helps determine the hardware and system requirements and also helps determine the overall system architecture.
c. Unit Testing Implementation: In this stage, the system is first developed in small programs called units, which are integrated in later stages. Each unit is developed and tested for functionality called unit testing.
d. Operation and Maintenance: The final stage of the waterfall method. The finished software is run and maintained. Maintenance includes fixing errors that were not found in the previous step. Improving the implementation of system units and improving system services as new needs arise.

3. RESULTS AND DISCUSSION

3.1. Procces of Analytical Hierarchy Process

In the Analytical Hierarchy Process method, to get the weights of the criteria and alternatives, it must go through a pairwise comparison process, namely where each criterion and alternative is compared with each other, after which it will be checked whether the weights are consistent or not, where the form of consistency can be measured from the CR (Consistency Ratio) value.) which must be less than the value 0.1.

The first process in the AHP method is assigning paired values to the desired criteria. If the first process has been completed, matrix normalization is carried out to find out whether the comparison values are consistent or not. If the CR value is <= 0.1, then it is considered consistent and continues with the process of assigning criteria weights, however if the CR value is more than 0.1 then it is considered inconsistent so another pair of criteria must be assigned as in the first process. If the process of assigning criteria weights has been completed, it continues with the process of assigning alternative pairwise comparison values. This process is the same as the process for finding whether the CR value is consistent or not.

1. Determining the qualitative scale of importance

Table I. Level of Importance

Intersity of Interest	Description
1	Equally Important
2	Closer to slightly more important
3	Slightly more important
4	Close to more important
5	More important
6	Approaching is very important
7	Extremely important
8	Approaching absolute is very important
9	Absolutely very important

2. Determine alternatives, criteria and comparison between criteria

The following alternatives will be examples of calculation subjects:

Table II. Alternative

Alternative Code	Alternative Name
AL1	Widya Liana
AL2	Fikri Rizaldi
AL3	Atika Handoko

The following criteria have been determined for the acceptance of student final project titles. The following is a list of criteria determined:

Table III. Criteria

Criteria Code	Criteria Name
K01	Degree of difficulty
K02	The same number of Titles
K03	Reference source
K04	Reference Accreditation

The following table is a comparison matrix between criteria from the criteria that have been determined:

Table IV. Criteria Comparison Matrix

Criteria Code	K01	K02	K03	K04
K01	**1**	1	3	1
K02	1	**1**	2	1
K03	0,3333	0,5	**1**	1
K04	1	1	1	**1**
Total	**2,3333**	**3,5**	**7**	**4**

3. Determining comparisons between alternatives

The following is a comparison matrix table between alternatives from each criterion:

Table V. Alternative Comparison Criterion 1

Alternative Code	AL1	AL2	AL3
AL1	**1**	3	3
AL2	0,3333	**1**	2
AL3	0,3333	0,5	**1**
Total	**1,6666**	**4,5**	**6**

Table VI. Alternative Comparison Criterion 2

Alternative Code	AL1	AL2	AL3
AL1	**1**	2	4
AL2	0,5	**1**	3
AL3	0,25	0,3333	**1**
Total	**1,75**	**3,3333**	**8**

Table VII. Alternative Comparison Criterion 3

Alternative Code	AL1	AL2	AL3
AL1	**1**	2	1
AL2	0,5	**1**	2
AL3	1	0,5	**1**
Total	**2,5**	**3,5**	**4**

Table VIII. Alternative Comparison Criterion 4

Alternative Code	AL1	AL2	AL3
AL1	**1**	2	3
AL2	0,5	**1**	6
AL3	0,3333	0,1666	**1**
Total	**1,8333**	**3,1666**	**10**

4. Making Matrix Normalization and priority weights

The following is a matrix normalization table and priority weights:

Table IX. Normalization Matrix and Criteria Priority Weight

#	K01	K02	K03	K04	Priority Weight
K01	0,4285	0,2857	0,4285	0,25	0, 3482
K02	0,4285	0,2857	0,2857	0,25	0,3125
K03	0,1428	0,1428	0,1428	0,25	0,1696
K04	0,4285	0,2857	0,1428	0,25	0,2768
#	**K01**	**K02**	**K03**	**K04**	**Priority Weight**

How to normalize the Matrix: Divide each matrix element by the total row of criteria.

Cell K01-K01 = 1 / 2,3333 = 0,4285
Cell K01-K02 = 1 / 3,5 = 0,2857
Cell K01-K03 = 3 / 7 = 0,4285
Cell K01-K04 = 1 / 4 = 0,25

Cell K02-K01 = 1 / 2,3333 = 0,4285
Cell K02-K02 = 1 / 3,5 = 0,2857
Cell K02-K03 = 2 / 7 = 0,2857
Cell K02-K04 = 1 / 4 = 0,25

Cell K03-K01 =	0,3333 / 2,3333 = 0,1428	Cell K04-K01 =	1 / 2,3333 = 0,4285
Cell K03-K02 =	0,5 / 3,5 = 0,1428	Cell K04-K02 =	1 / 3,5 = 0,2857
Cell K03-K03 =	1 / 7 = 0,1428	Cell K04-K03 =	1 / 7 = 0,1428
Cell K03-K04 =	1 / 4 = 0,25	Cell K04-K04 =	1 / 4 = 0,25

How to Find Priority Weight: Averaging each row of the normalized matrix.

First line =	0,4285 + 0,2857 + 0,4285 + 0,25 = 0,3482
Second line =	0,4285 + 0,2857 + 0,2857 + 0,25 = 0,3125
Third line =	0,1428 + 0,1428 + 0,1428 + 0,25 = 0,1696
Fourth line =	0,4285 + 0,2857 + 0,1428 + 0,25 = 0,2768

5. Calculating Matrix Consistency

Table X. Matrix Consistency

#	K01	K02	K03	K04	CM
K01	0,4285	0,2857	0,4285	0,25	4,1536
K02	0,4285	0,2857	0,2857	0,25	4,0854
K03	0,1428	0,1428	0,1428	0,25	4,2370
K04	0,4285	0,2857	0,1428	0,25	3,9996

How to Find Consistency Measure: Multiply the criteria comparison matrix with the priority weight of each row.

First line	= [(1*0,3482)+(1*0,3125)+(3*0,1696)+(1*0,2768)]/0,3482
	= [0,3482 + 0,3125 + 0,5088 + 0,2768] / 0,3482
	= 4,1536
Second line	= [(1*0,3482)+(1*0,3125)+(2*0,1696)+(1*0,2768)]/0,3482
	= [0,3482 + 0,3125 + 0,3392 + 0,2768] / 0,3125
	= 4,0854
Third line	= [(0,3333*0,3482)+(0,5*0,3125)+(1*0,1696)+(1*0,2768)]/0,1696
	= [0,1160 + 0,1562 + 0,1696 + 0,2768] / 0,1696
	= 4,2370
Fourth line	= [(1*0,3482)+(1*0,3125)+(1*0,1696)+(1*0,2768)]/0,1696
	= [0,3482 + 0,3125 + 0,1696 + 0,2768] / 0,2768
	= 3,9996
λmax	= (4,1536 + 4,0854 + 4,2370 + 3,9996)/4
	= 16,4756 / 4
	= 4,1189

6. Calculating the Consistency Index

$$\mathbf{CI} = \frac{\lambda max - n}{n - 1} = \frac{4{,}1189 - 4}{4 - 1} = 0{,}0396$$

Based on Saaty's theory, the Ratio Index has been determined based on the order of the matrix (number of criteria), the following is shown in table XI

Table XI. Ratio Index

Ordo Matriks	1	2	3	4	5	6	7	8	9	10
Ratio Index	0	0	0,58	0,9	1,12	1,24	1,32	1,41	1,46	1.49

Because the matrix consists of 4 criteria, RI = 0.9. From CI and RI, we can calculate the Consistency Ratio / CR by finding CI / RI = 0.0396 / 0.9 = 0.044.

For CR values of 0 - 0.1, it is considered **consistent**, if more than that, it is considered **inconsistent**. So that the comparison given for the criteria is **consistent**.

7. Finding the priority weight value of Alternatives

Table XII. Alternative Priority Weights from Criterion 1

#	AL1	AL2	AL3	Priority Weight
AL1	0,6000	0,6666	0,5	0,5888
AL2	0,1999	0,2222	0,3333	0,2518
AL3	0,1999	0,1111	0,1666	0,1592

Table XIII. Alternative Priority Weights from Criterion 2

#	AL1	AL2	AL3	Priority Weight
AL1	0,5714	0,6000	0,5	0,5571
AL2	0,2857	0,3000	0,375	0,3202
AL3	0,1428	0,0999	0,125	0,1225

Table XIV. Alternative Priority Weights from Criterion 3

#	AL1	AL2	AL3	Priority Weight
AL1	0,4	0,5714	0,25	0,4204
AL2	0,02	0,2857	0,5	0,2685
AL3	0,4	0,1428	0,25	0,2642

Table XV. Alternative Priority Weights from Criterion 4

#	AL1	AL2	AL3	Priority Weight
AL1	0,5454	0,6315	0,3	0,4923
AL2	0,2727	0,3157	0,6	0,3961
AL3	0,1818	0,0526	0,1	0,1114

8. Finding the value and ranking of alternatives

Table XVI. Alternative Value and Ranking

Alternatif	K01	K02	K03	K04	Nilai	Rank
Bobot Prioritas	0,3482	0,3125	0,1696	0,2768		
AL1	0,5888	0,5571	0,4204	0,4923	0,5864	**1**
AL2	0,2518	0,3202	0,2685	0,3961	0,3427	**3**
AL3	0,1592	0,1225	0,2642	0,1114	0,5724	**2**

Based on the table above, to find the value is to multiply the priority weight of the criteria by each row of the alternative priority weight matrix.

Baris Pertama = (0,5888*0,3482)+(0,5571*0,3125)+(0,4204*0,1696)+(0,4923*0,2768)
= 0,2050+ 0,1740 + 0,0712 + 0,1362
= 0,5864

Baris Kedua = (0,2518*0,3482)+(0,3202*0,3125)+(0,2685*0,1696)+(0,3961*0,2768)
= 0,0876 + 0,1000 + 0,0455 + 0,1096
= 0,3427

Baris Ketiga = (0,1592*0,3482)+(0,1225*0,3125)+(0,2642*0,1696)+(0,1114*0,2768)
= 0,0554 + 0,0382 + 0,448 + 0,0308
= 0,5724

3.2. Discussion of Program Interface

The home page explains that, when the admin has logged into the system, the admin will be immediately directed to the Home display. The home display explains the preference values that will be used in comparing criteria and alternatives. Preference values can be changed, the value provisions and descriptions. Not only the preference value, the home display also explains the criteria that will be used in comparing alternatives.

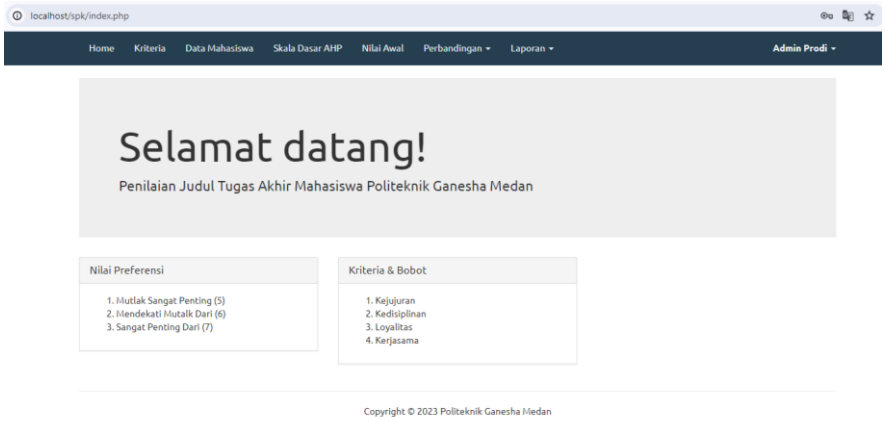

Figure 2. Home Page

The criteria comparison display explains that, when we have determined the criteria we want to use, we must assess the criteria comparison to get the weight of these criteria.

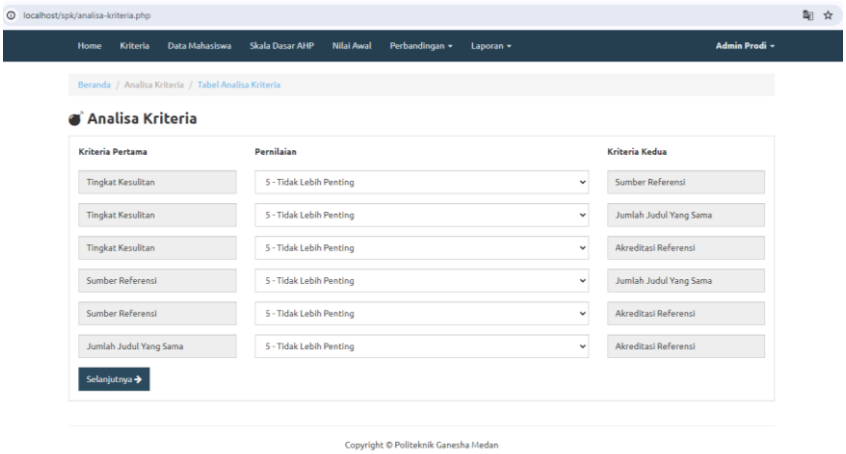

Figure 3. Criteria Comparison Page

The student data input display explains that before we compare alternatives, we must register the student as an alternative. The aim is to introduce the student as an alternative that will be calculated.

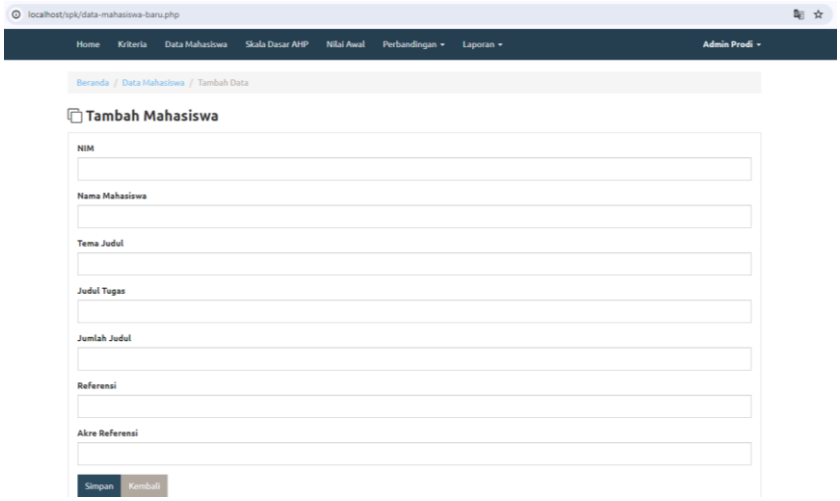

Figure 4. Student Data Input Page

The student assessment input display explains that the student data entered previously must be assessed first. At this stage, it is very easy for the admin or head of study program to sort the titles of students' final

assignments because at this stage the head of study program can assess the suitability of the student in presenting the title he has proposed. If the title is considered too heavy then the title will not be able to be compared with other titles or will not be able to proceed to the alternative comparison stage in the sense of being rejected.

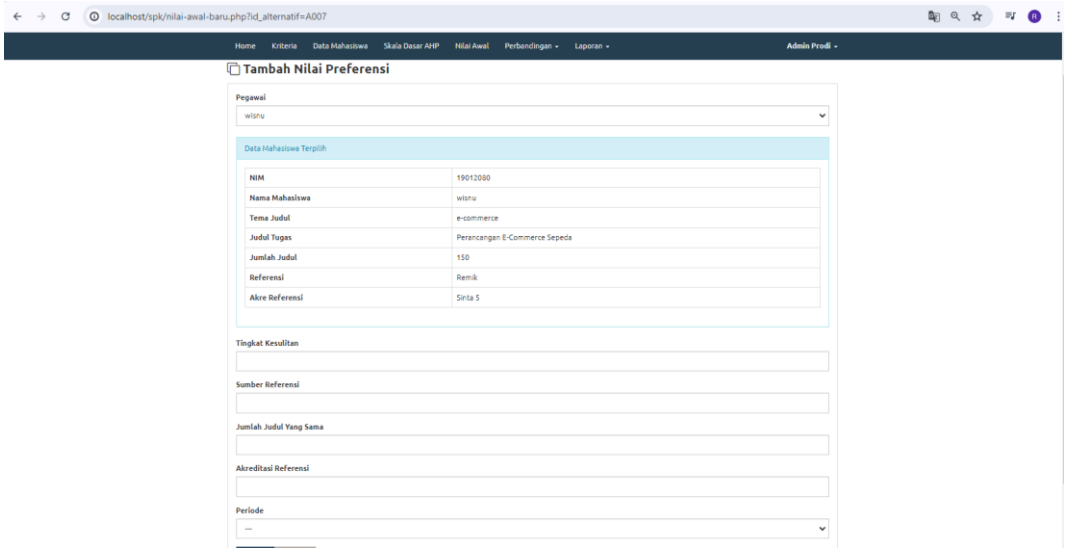

Figure 5. Student Assessment Input Page

The alternative comparison display explains that titles that have been assessed as good by the head of study program will undergo a comparison stage so that the results are obtained as to which titles are good and which titles are not suitable to be used as final assignments. Comparison of alternatives based on previously determined criteria.

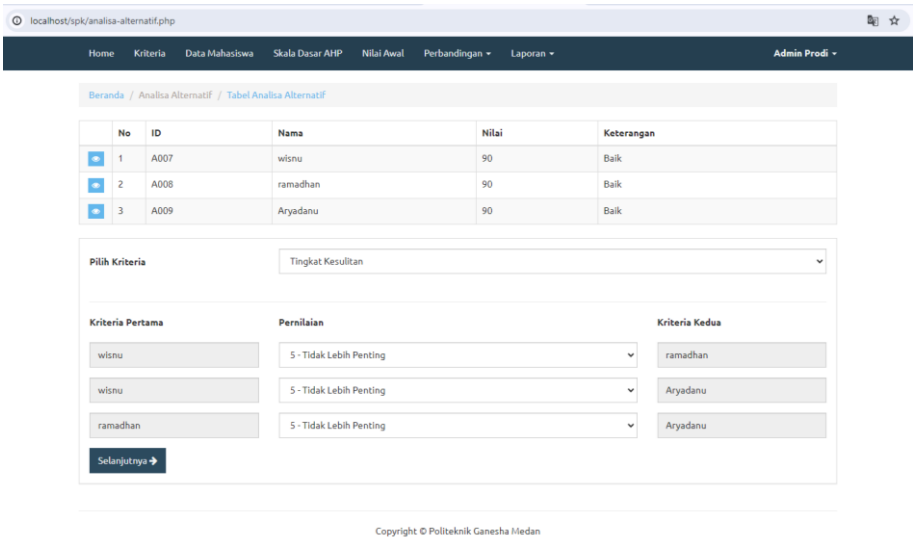

Figure 6. Alternative Comparison Page

The report display explains that alternatives that have passed the comparison stage based on criteria will get the final result so that it can be determined which title is good for the final assignment and which is not. If the student's title is rejected, the student can reapply with a new title.

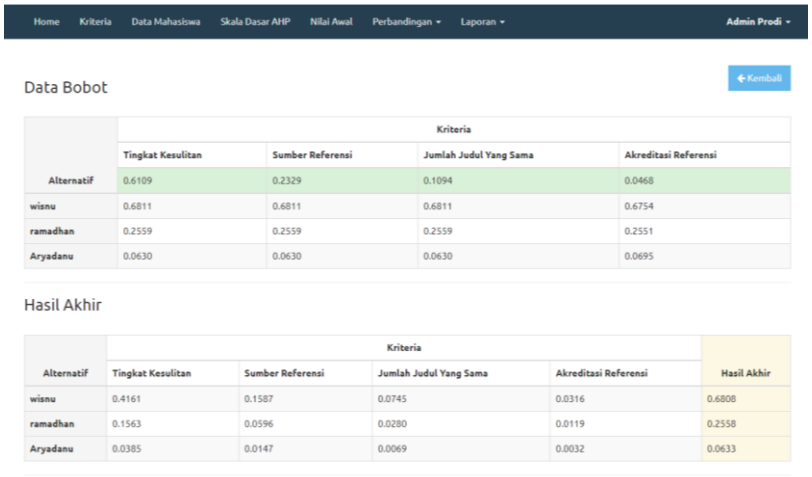

Figure 7. Report Page

4. CONCLUSION

Based on the results of the research and discussion, the following conclusions can be drawn:

1. Later, students will be given a title submission form by academics, which will later be collected and given to the head of study program. Then the Head of Study Program will assess whether the title is worthy of being appointed as a final assignment or not. If eligible, the assessment results will be announced. If it is not appropriate, the student can resubmit the title of their final assignment and see the references based on the title received so that students know what title is standardized by the head of study program. The head of study program assessment is also based on the level of difficulty so that students can determine whether the title is difficult or not before submitting it as a final assignment.
2. The calculation results from the decision support system application for accepting students' final assignment titles using the AHP method in the Informatics Management study program at Ganesha Polytechnic Medan are that Widya Liana (AL1) got first place with a score of 0.5864, Atika Handoko (AL3) got second place. with a result value of 0.5724 and on behalf of Fikri Rizaldi (AL2) getting the last ranking with a result value of 0.3427.

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