Decision Support System For Prospective Scholarship Recipients Using Smarter And Forward Chaining Method

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Abstract

The purpose of this research is to design and build a web-based decision support system application to determine prospective scholarship recipients at MAN 2 Yogyakarta and test its reliability. The Decision Support System is a problem-solving system with supporting tools. This system can solve problems using algorithm methods. One of the decision support system methods that can be applied to scholarship cases at MAN 2 Yogyakarta is the Simple Multi-Attribute Rating Technique Exploiting Ranks (SMARTER) method and forward chaining. The SMARTER method is a decision support method by determining the criteria and sub-criteria and their weight using the ROC (Rank Order Centroid). Meanwhile, the forward chaining method is a search method or a forward tracking technique that starts with existing information and combines rules to produce a conclusion or goal. The advantages of the DSS that have been developed are as follows. (1) The DSS built can be used by the scholarship selection team to recommend students who have the potential to get scholarships more quickly and objectively (2) The DSS for prospective scholarship recipients that was developed uses two methods of calculation, namely the Simple Multi-Attribute Rating Technique Exploiting Ranks (SMARTER) and Forward Chaining methods so that the prediction results are better and faster. The SMART method emphasizes more detailed criteria and the Forward Chaining Method allows for a faster selection process.

Keywords : Decision Support System, Forward Chaining Method, Simple Multi-Attribute Rating Technique Exploiting Ranks (SMARTER) Method, Website.

1. INTRODUCTION

MAN 2 Yogyakarta is a secondary education unit with Islamic characteristics under the auspices of the Ministry of Religion. There are 2 ongoing scholarships at MAN 2 Yogyakarta, namely the KMS (Towards Prosperity Card) scholarship and the PIP (Smart Indonesia Program) scholarship. The categories that are considered for scholarship recipients are madrasa students who are orphans/orphans/children with special needs (ABK), students who come from families who are vulnerable to poverty, have KIP/KKS/PKH, and have not received PIP, and students who affected by the national disaster due to Covid-19, namely parents experiencing layoffs. The source of funds for the two scholarships is from the government, however, this KMS scholarship is given only to residents of the City of Yogyakarta. The scholarship recipient quota proposed by the school for KMS scholarships is 20 students and for PIP scholarships is 25 students.

The selection process is carried out by the management, namely for KMS scholarships managed by the Treasurer of the Committee while PIP scholarships are managed by the Student Affairs and Counseling (BK) section of the Administration. The process of channeling scholarship funds begins with students submitting themselves as potential recipients of the PIP scholarship by gathering the necessary conditions. The required files are collected by the Counseling
Guidance teacher. From Counseling Guidance the data is then selected again to check the completeness of the files from each student. The data is then submitted to the Madrasah KSKK Directorate. The Madrasah KSKK Directorate will collect student data based on suggestions from Madrasahs (schools) specifically allocated to new students as a result of PPDB implementation.

The school offers scholarships, especially for outstanding students. The Counseling Guidance Teacher conducts the selection in several stages. Each selection stage requires a lot of time and effort to look at student data one by one. The process that has been carried out so far is by collecting files from students who will submit themselves as potential scholarship recipients, then the files are checked for completeness. The next stage is summarizing student data and then selecting to group into small groups to facilitate assessment. After obtaining the selected data through several considerations, then the selected data will be reported for submission to the Madrasah KSKK Directorate. Apart from wasting a lot of time, the scholarship selection method at MAN 2 Yogyakarta has not yet implemented a decision support system. Therefore it is necessary to have a decision support method for selecting prospective scholarship recipients.

The Decision Support System is a problem-solving system with supporting tools [2]. This system can solve problems using algorithm methods. One of the decision support system methods that can be applied to scholarship cases at MAN 2 Yogyakarta is the Simple Multi-Attribute Rating Technique Exploiting Ranks (SMARTER) method and forward chaining. The SMARTER method is a decision support method by determining the criteria and sub-criteria and their weight using the ROC (Rank Order Centroid). Meanwhile, the forward chaining method is a search method or a forward tracking technique that starts with existing information and combines rules to produce a conclusion or goal [3].

The purpose of this research is to design and build a web-based decision support system application to determine prospective scholarship recipients at MAN 2 Yogyakarta and test its reliability.

Saleh applies the Simple Multi-Attribute Rating Technique Exploiting Ranks (SMARTER) method in making a decision to select a computer laboratory assistant according to the relevant criteria. Priority criteria such as English language test results, academic potential test results, practicum test results, interview results, results of recommendations from the head of the laboratory, and semester. The results of this study stated that of the 10 applicant data used as an alternative to testing the SMARTER method, there were 8 applicants who were declared accepted and in accordance with the actual results that have been running so far with an accuracy rate of 80% [4].

2. METHOD

A context diagram is the highest level in a data flow diagram that contains one process but includes basic inputs, general systems, and outputs. The context diagram can be seen in Figure 1 below.

![Figure 1. Context diagram](image-url)
In the DSS that will be developed, the users consist of Administrators and Principals. The administrator of this DSS is the Scholarship Selection Team. The administrator is in charge of entering student data, category data, and subcategory data. DSS provides output to the admin in the form of information on students applying for scholarships, categories, subcategories, and calculations. The Principal has access to view reports on the results of determining scholarships.

DFD level 1 is used to provide a more detailed description of the processes that occur in the DSS and the data storage used. DFD Level 1 can be seen in Figure 2 below.

2.1. Determine the criteria and sub-criteria

Determine the criteria and sub-criteria The criteria that will be used according to the results of interviews with Counseling Guidance teachers include:

Table 1. Criteria

<table>
<thead>
<tr>
<th>No</th>
<th>Code</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C1</td>
<td>Family Economy</td>
</tr>
<tr>
<td>2</td>
<td>C2</td>
<td>Child Status</td>
</tr>
<tr>
<td>3</td>
<td>C3</td>
<td>Discipline</td>
</tr>
<tr>
<td>4</td>
<td>C4</td>
<td>School Achievement</td>
</tr>
</tbody>
</table>

From the following criteria determine the sub-criteria:

Table 2. Sub Criteria

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>Sub Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Family Economy</td>
<td>Lower (&lt; 3 million)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intermediate (4-10 million)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Upper (&lt;10 million)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No parents</td>
</tr>
<tr>
<td>2</td>
<td>Child Status</td>
<td>No father</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No matter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Discipline (absent &lt; 3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enough Discipline (absent = 4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lazy (absent &gt; 5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Top 1-3 (high achievers)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Top 4 (achievement)</td>
</tr>
<tr>
<td>3</td>
<td>Discipline</td>
<td>Top 5-10 (quite accomplished)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;top 10 (non-performing)</td>
</tr>
<tr>
<td>4</td>
<td>School Achievement</td>
<td></td>
</tr>
</tbody>
</table>

2.2. Determine the weight value of each criterion.

Table 3. Criteria and Weight

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>Weight (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Family Economy</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>Child Status</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>Discipline</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>School Achievement</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
2.3. Determine the weight value of each sub-criteria

Table 1. Weight value for family economic criteria

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lower</td>
<td>1</td>
<td>½</td>
<td>1/3</td>
<td>0,611</td>
</tr>
<tr>
<td>2</td>
<td>Intermediate</td>
<td>0</td>
<td>½</td>
<td>1/3</td>
<td>0,278</td>
</tr>
<tr>
<td>3</td>
<td>Upper</td>
<td>0</td>
<td>0</td>
<td>1/3</td>
<td>0,111</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>1,000</td>
</tr>
</tbody>
</table>

Calculation of weight using the formula:

\[ W_k = \left(\frac{1}{c}\right) \sum_{i=1}^{c} c(1/i) \]

Weight calculation for 3 sub-criteria:

- W1 = (1+1/2+1/3)/3 = 0,611
- W2 = (0+1/2+1/3)/3 = 0,278
- W3 = (0+0+1/3)/3 = 0,111

Table 4. Weight Value for Child Status Criteria

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>W4</th>
<th>Bobot</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No parents</td>
<td>1</td>
<td>½</td>
<td>1/3</td>
<td>¼</td>
<td>0,521</td>
</tr>
<tr>
<td>2</td>
<td>No father</td>
<td>0</td>
<td>½</td>
<td>1/3</td>
<td>¼</td>
<td>0,271</td>
</tr>
<tr>
<td>3</td>
<td>No matter</td>
<td>0</td>
<td>0</td>
<td>1/3</td>
<td>¼</td>
<td>0,146</td>
</tr>
<tr>
<td>4</td>
<td>Normal</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>¼</td>
<td>0,063</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.000</td>
</tr>
</tbody>
</table>

Table 5. Weight value for Discipline Criteria

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Discipline</td>
<td>1</td>
<td>½</td>
<td>1/3</td>
<td>0,611</td>
</tr>
<tr>
<td>2</td>
<td>Enough Discipline</td>
<td>0</td>
<td>½</td>
<td>1/3</td>
<td>0,278</td>
</tr>
<tr>
<td>3</td>
<td>Lazy</td>
<td>0</td>
<td>0</td>
<td>1/3</td>
<td>0,111</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>1.000</td>
</tr>
</tbody>
</table>

Weight calculation for 4 sub-criteria:

- W1 = (1+1/2+1/3+1/4)/4 = 0,521
- W2 = (0+1/2+1/3+1/4)/4 = 0,271
- W3 = (0+0+1/3+1/4)/4 = 0,146
- W4 = (0+0+0+1/4)/4 = 0,063

Table 6. School Achievement weight value

<table>
<thead>
<tr>
<th>No</th>
<th>Criteria</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>W4</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>high achievers</td>
<td>1</td>
<td>1/2</td>
<td>1/3</td>
<td>1/4</td>
<td>0,521</td>
</tr>
<tr>
<td>2</td>
<td>achievement</td>
<td>0</td>
<td>1/2</td>
<td>1/3</td>
<td>1/4</td>
<td>0,271</td>
</tr>
<tr>
<td>3</td>
<td>quite accomplished</td>
<td>0</td>
<td>0</td>
<td>1/3</td>
<td>1/4</td>
<td>0,146</td>
</tr>
<tr>
<td>4</td>
<td>non-performing</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1/4</td>
<td>0,063</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.000</td>
</tr>
</tbody>
</table>

The following is the data that will be calculated to determine students who are eligible for scholarships.
Table 7. Student data

<table>
<thead>
<tr>
<th>No</th>
<th>Name of Student</th>
<th>Family Economy</th>
<th>Status of Children</th>
<th>School Achievement</th>
<th>Discipline (total absences)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anjas Raditya Prabowo</td>
<td>2.000.000 piatu</td>
<td>4</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Muhammad Afnan Razan</td>
<td>2.000.000 normal</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Rifky Putra Septanuary</td>
<td>2.500.000 yatim</td>
<td>7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Septian Noordiayanto</td>
<td>3.000.000 normal</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Yuningsih Sulistyowati</td>
<td>2.000.000 normal</td>
<td>12</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Carissa Azahra C</td>
<td>4.000.000 piatu</td>
<td>5</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Muh Fuad Khalish NT</td>
<td>8.000.000 normal</td>
<td>7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Siti Karlina Lubis</td>
<td>3.500.000 piatu</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Tino Adi Prasetyo</td>
<td>7.000.000 normal</td>
<td>5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Anisah Tata Fidefi</td>
<td>3.000.000 normal</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Khoirul Imam</td>
<td>2.000.000 normal</td>
<td>10</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Muhammad Ali F Z</td>
<td>5.000.000 normal</td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Muhammad Zeba J</td>
<td>4.000.000 piatu</td>
<td>7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Muhammad Chairul EB.</td>
<td>6.000.000 normal</td>
<td>8</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Syarifah Nabil RA.</td>
<td>2.000.000 normal</td>
<td>9</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

The following are the student's qualitative data:

Table 8. Student Qualitative Data

<table>
<thead>
<tr>
<th>No</th>
<th>Name of Student</th>
<th>Family Economy</th>
<th>Status of Children</th>
<th>School Achievement</th>
<th>Discipline (total absences)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anjas Raditya Prabowo</td>
<td>Lower No matter achievement</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Muhammad Afnan Razan</td>
<td>Lower Normal high achievers</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Rifky Putra Septanuary</td>
<td>Lower No father quite accomplished</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Septian Noordiayanto</td>
<td>Lower Normal quite accomplished</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Yuningsih Sulistyowati</td>
<td>Lower Normal Tidak Berprestasi Enough Discipline</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Carissa Azahra C</td>
<td>Intermediate No Mother quite accomplished</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Muh Fuad Khalish NT</td>
<td>Intermediate Normal quite accomplished</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Siti Karlina Lubis</td>
<td>Lower No matter quite accomplished</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Tino Adi Prasetyo</td>
<td>Menengah Normal quite accomplished</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Anisah Tata Fidefi</td>
<td>Lower Normal quite accomplished</td>
<td>Enough Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Khoirul Imam</td>
<td>Lower Normal quite accomplished</td>
<td>Enough Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Muhammad Ali F Z</td>
<td>Intermediate Normal high achievers</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Muhammad Zeba J</td>
<td>Intermediate No matter quite accomplished</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Muhammad Chairul EB.</td>
<td>Intermediate Normal quite accomplished</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Syarifah Nabil RA.</td>
<td>Lower Normal quite accomplished</td>
<td>Discipline</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

criteria based on sub-criteria weight values, while the results of the normalization can be seen in Table 2.10

Table 9. Normalization result data

<table>
<thead>
<tr>
<th>No</th>
<th>Student Name</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anjas Raditya Prabowo</td>
<td>0.6110</td>
<td>0.146</td>
<td>0.271</td>
<td>0.611</td>
</tr>
<tr>
<td>2</td>
<td>Muhammad Afnan Razan</td>
<td>0.6110</td>
<td>0.063</td>
<td>0.521</td>
<td>0.611</td>
</tr>
<tr>
<td>3</td>
<td>Rifky Putra Septanuary</td>
<td>0.6110</td>
<td>0.271</td>
<td>0.146</td>
<td>0.611</td>
</tr>
<tr>
<td>4</td>
<td>Septian Noordiayanto</td>
<td>0.6110</td>
<td>0.063</td>
<td>0.146</td>
<td>0.611</td>
</tr>
<tr>
<td>5</td>
<td>Yuningsih Sulistyowati</td>
<td>0.6110</td>
<td>0.063</td>
<td>0.063</td>
<td>0.278</td>
</tr>
<tr>
<td>6</td>
<td>Carissa Azahra C</td>
<td>0.2278</td>
<td>0.146</td>
<td>0.146</td>
<td>0.611</td>
</tr>
<tr>
<td>7</td>
<td>Muh Fuad Khalish NT</td>
<td>0.2278</td>
<td>0.063</td>
<td>0.146</td>
<td>0.611</td>
</tr>
<tr>
<td>8</td>
<td>Siti Karlina Lubis</td>
<td>0.6110</td>
<td>0.146</td>
<td>0.146</td>
<td>0.611</td>
</tr>
<tr>
<td>9</td>
<td>Tino Adi Prasetyo</td>
<td>0.2278</td>
<td>0.063</td>
<td>0.146</td>
<td>0.611</td>
</tr>
<tr>
<td>10</td>
<td>Anisah Tata Fidefi</td>
<td>0.6110</td>
<td>0.063</td>
<td>0.146</td>
<td>0.278</td>
</tr>
</tbody>
</table>
### 2.4. Determine the Utility Value

The normalized value will be converted into a utility value using the equation. The following utility values for each criterion can be seen in Table 10.

#### Table 10. Utility Value

<table>
<thead>
<tr>
<th>No</th>
<th>Nama Siswa</th>
<th>K1</th>
<th>K2</th>
<th>K3</th>
<th>K4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anjas Raditya Prabowo</td>
<td>21,385</td>
<td>4,380</td>
<td>5,420</td>
<td>9,165</td>
</tr>
<tr>
<td>2</td>
<td>Muhammad Afnan Razan</td>
<td>21,385</td>
<td>1,890</td>
<td>10,420</td>
<td>9,165</td>
</tr>
<tr>
<td>3</td>
<td>Rifky Putra Septauary</td>
<td>21,385</td>
<td>8,130</td>
<td>2,920</td>
<td>9,165</td>
</tr>
<tr>
<td>4</td>
<td>Septian Noordiyanto</td>
<td>21,385</td>
<td>1,890</td>
<td>2,920</td>
<td>9,165</td>
</tr>
<tr>
<td>5</td>
<td>Yuningsih Sulistyowati</td>
<td>21,385</td>
<td>1,890</td>
<td>1,260</td>
<td>4,170</td>
</tr>
<tr>
<td>6</td>
<td>Carissa Azahra Candraningtyas</td>
<td>7,973</td>
<td>4,380</td>
<td>2,920</td>
<td>9,165</td>
</tr>
<tr>
<td>7</td>
<td>Muh Fuad Khalish Nur Tsany</td>
<td>7,973</td>
<td>1,890</td>
<td>2,920</td>
<td>9,165</td>
</tr>
<tr>
<td>8</td>
<td>Siti Karlina Lubis</td>
<td>21,385</td>
<td>4,380</td>
<td>2,920</td>
<td>9,165</td>
</tr>
<tr>
<td>9</td>
<td>Tino Adi Prasetyo</td>
<td>7,973</td>
<td>1,890</td>
<td>2,920</td>
<td>9,165</td>
</tr>
<tr>
<td>10</td>
<td>Anisah Tata Fidefi</td>
<td>21,385</td>
<td>1,890</td>
<td>2,920</td>
<td>4,170</td>
</tr>
<tr>
<td>11</td>
<td>Khoirul Imam</td>
<td>21,385</td>
<td>1,890</td>
<td>1,260</td>
<td>4,170</td>
</tr>
<tr>
<td>12</td>
<td>Muhammad Alif Zulfikar</td>
<td>7,973</td>
<td>1,890</td>
<td>2,920</td>
<td>9,165</td>
</tr>
<tr>
<td>13</td>
<td>Muhammad Zeba Jayawardana</td>
<td>7,973</td>
<td>4,380</td>
<td>2,920</td>
<td>9,165</td>
</tr>
<tr>
<td>14</td>
<td>Muhammad Chairul Endra B.</td>
<td>7,973</td>
<td>1,890</td>
<td>2,920</td>
<td>9,165</td>
</tr>
<tr>
<td>15</td>
<td>Syarifah Nabila Rihhadatul A.</td>
<td>21,385</td>
<td>1,890</td>
<td>2,920</td>
<td>9,165</td>
</tr>
</tbody>
</table>

Calculation:

\[ U_{Aafreda}(C_1) = 0.611 \times 35 = 21.385 \]

\[ U_{Aafreda}(C_2) = 0.146 \times 30 = 4.380 \text{...ect.} \]

The final result is calculated by the utility value, then the results are summed.

#### Table 11. SMARTER Method Calculation Results

<table>
<thead>
<tr>
<th>No</th>
<th>Nama Siswa</th>
<th>K1</th>
<th>K2</th>
<th>K3</th>
<th>K4</th>
<th>Hasil</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Anjas Raditya Prabowo</td>
<td>21,385</td>
<td>4,380</td>
<td>5,420</td>
<td>9,165</td>
<td>40,350</td>
</tr>
<tr>
<td>2</td>
<td>Muhammad Afnan Razan</td>
<td>21,385</td>
<td>1,890</td>
<td>10,420</td>
<td>9,165</td>
<td>42,860</td>
</tr>
<tr>
<td>3</td>
<td>Rifky Putra Septauary</td>
<td>21,385</td>
<td>8,130</td>
<td>2,920</td>
<td>9,165</td>
<td>41,600</td>
</tr>
<tr>
<td>4</td>
<td>Septian Noordiyanto</td>
<td>21,385</td>
<td>1,890</td>
<td>2,920</td>
<td>9,165</td>
<td>35,360</td>
</tr>
<tr>
<td>5</td>
<td>Yuningsih Sulistyowati</td>
<td>21,385</td>
<td>1,890</td>
<td>1,260</td>
<td>4,170</td>
<td>28,705</td>
</tr>
<tr>
<td>6</td>
<td>Carissa Azahra Candraningtyas</td>
<td>7,973</td>
<td>4,380</td>
<td>2,920</td>
<td>9,165</td>
<td>24,438</td>
</tr>
<tr>
<td>7</td>
<td>Muh Fuad Khalish Nur Tsany</td>
<td>7,973</td>
<td>1,890</td>
<td>2,920</td>
<td>9,165</td>
<td>21,948</td>
</tr>
<tr>
<td>8</td>
<td>Siti Karlina Lubis</td>
<td>21,385</td>
<td>4,380</td>
<td>2,920</td>
<td>9,165</td>
<td>37,850</td>
</tr>
<tr>
<td>9</td>
<td>Tino Adi Prasetyo</td>
<td>7,973</td>
<td>1,890</td>
<td>2,920</td>
<td>9,165</td>
<td>21,948</td>
</tr>
<tr>
<td>10</td>
<td>Anisah Tata Fidefi</td>
<td>21,385</td>
<td>1,890</td>
<td>2,920</td>
<td>4,170</td>
<td>30,365</td>
</tr>
</tbody>
</table>
Calculating:

\[ n_1 = 21,385 + 4,380 + 5,420 + 9,165 = 40,350 \]
\[ n_2 = 21,385 + 1,890 + 10,420 + 9,165 = 42,860 \]
\[ n_3 = 21,385 + 8,130 + 2,920 + 9,165 = 41,600, \text{ etc} \]

2.5. Calculation method Forward Chaining

Furthermore, the results of SMARTER calculations are then used to determine the eligibility of scholarship recipients using the Forward Chaining method based on the following rules:

<table>
<thead>
<tr>
<th>Table 12. Rule Base</th>
</tr>
</thead>
<tbody>
<tr>
<td>IF ranking ( \leq 5 )</td>
</tr>
<tr>
<td>IF ranking ( &gt; 5 )</td>
</tr>
</tbody>
</table>

The following is the result of the calculation obtained:

<table>
<thead>
<tr>
<th>Table 13. The results of the selection using the forward chaining method</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
</tr>
<tr>
<td>----</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>7</td>
</tr>
<tr>
<td>8</td>
</tr>
<tr>
<td>9</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>11</td>
</tr>
<tr>
<td>12</td>
</tr>
<tr>
<td>13</td>
</tr>
<tr>
<td>14</td>
</tr>
<tr>
<td>15</td>
</tr>
</tbody>
</table>

From the calculation results, 5 students who received scholarships were Rifky Putra Septanuary, Anjas Raditya Prabowo, Muhammad Afnan Razan, Siti Karlina Lubis, and From the calculation results, 5 students who received scholarships were Rifky Putra Septanuary, Anjas Raditya Prabowo, Muhammad Afnan Razan, Siti Karlina Lubis, and Septian Noordiyanto
3. RESULT AND DISCUSSION

3.1. Result

The developed DSS is implemented in the form of web pages that can be accessed by users based on their authority. The login page is used to guarantee that users who will enter the DSS have the authority to access it. Users are required to enter a username and password.

![Login Page](image2.png)

Figure 2. Login Page

The Student Data page is used by administrators to enter student data that register for the scholarship program.

![Student Data Page](image3.png)

Figure 3. Student Data Page

The Category Data page is used by the administrator to input each category and its weight. The total weighting value of each category must be equal to 100.
The sub-category page is used by the administrator to manage sub-category data. The data are column name of category, name of subcategory, order, minimum limit, weight of subcategory, and action.

The prediction results page is a page that is used for admins to see the prediction results of students who receive scholarships.
Black box testing is carried out by prospective DSS users and Thesis Supervisors. Testing is done by running each module in the DSS. The goal is to find out whether each module can work according to its function. The results of the tests performed show that the DSS is running well.

Alpha testing was carried out by 30 (thirty) respondents. Respondents run DSS applications that have been developed. Next, the respondents filled out a list of questions to find out their responsive assessment of the performance of the DSS being built. Alpha test results show the system can run well.

3.2. Discussion

The advantages of the DSS that have been developed are as follows.

1) The DSS built can be used by the scholarship selection team to recommend students who have the potential to get scholarships more quickly and objectively.
2) The DSS for prospective scholarship recipients that was developed uses two methods of calculation, namely the Simple Multi-Attribute Rating Technique Exploiting Ranks (SMARTER) and Forward Chaining methods so that the prediction results are better and faster. The SMART method emphasizes more detailed criteria and the Forward Chaining Method allows for a faster selection process.

The weaknesses of the system, are as follows:

1) Does not consider dynamic aspects, tends to only consider static data, and does not consider dynamic aspects such as changes in economic or social conditions that may influence decisions.
2) Does not consider non-numeric factors still considers numerical factors and does not consider non-numeric factors such as individual needs or preferences which are difficult to measure quantitatively.
4. CONCLUSION

The conclusion of this research is as follows:

1) This research has succeeded in building a decision support system application for prospective scholarship recipients using the Simple Multi-Attribute Rating Technique Exploiting Ranks (SMATER) and the Forward Chaining method has been successfully built. The DSS can assist schools in determining scholarship recipients quickly and on target.

2) The results of black box testing show that the DSS developed functionally can be used and runs well. Alpha test results were carried out by distributing questionnaires to 30 respondents indicating that the developed system was very reliable.

5. SUGGESTION

1) The system is developed considering dynamic aspects, such as changes in economic or social conditions that may influence decisions.

2) The system considers non-numerical factors such as individual needs or preferences that are difficult to measure quantitatively.

REFERENCES


