International Journal of Information System & Technology
Akreditasi No. 158/E/KPT/2021 | Vol. 8, No. 1, (2024), pp. 6-11

Decision Support System for Selection of Scholarship Recipient Students Using Tsukamoto Method Fuzzy Logic

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Abstract

Scholarship selection is an important process in determining the acceptance of educational assistance based on established criteria. Decision Support Systems (DSS) have proven their value in assisting complex decision making. In the context of scholarship selection, Tsukamoto's fuzzy approach in decision support systems is an effective tool for modeling the complexity and uncertainty of selection criteria. This system utilizes fuzzy logic to connect variable inputs such as academic achievement, financial condition, and other factors to output in the form of membership values in the scholarship acceptance category. The fuzzy rules defined by educational experts and practitioners enable the system to interpret conditions that are closer to human thinking. Thus, Tsukamoto's fuzzy approach in decision support systems becomes an effective tool in simplifying the complexity of scholarship selection, while providing data-based solutions. More objective and comprehensive.

Keywords: *Decision Support System, Scholarship, Fuzzy Tsukamoto Method*

1. Introduction

Scholarships are funding that does not come from individual funding or a group of parents, but is provided by the government, private companies, universities and educational institutions that can provide the ultimate opportunity to increase their human capacity through education. Full-time scholarships are given to students who are eligible to receive them based on classification, quality and competency in accordance with the regulations that have been developed. The regulations regarding student scholarships have been reinforced in the Indonesian Republic of Indonesia Republic of Indonesia's Republic of Indonesia Law No. 20 of 2003 concerning the National Education System, Chapter V article 12 (1.c), stating that every student in every educational unit has the right to receive scholarships for those who have achieved their achievements, but also for those who are young it's not enough finance education.

The Delcision Support System (DSS) or Delcision Support System (DSS) is a system that can solve problems with accurate and organized calculations and research. This system is supposed to be able to capture accidents by means of either being elucidated or not elucidated. Where people don't know what the error is, they always have to round it up. On the decision-making process. The fuzzy logic model works by using the membership degree of a value, then used to determine the desired result, based on predetermined rules. The Tsukamoto Method is based on the concept of monotonous reasoning. In the monotonic reasoning method, the crisp set value in the consequent area can be obtained directly based on the fire strength in the antecedent. One of the conditions that must be met in this reasoning method is that the fuzzy set must consequently be monotone (either monotone increasing or monotonic decreasing). This method was chosen because this method will select the best alternative from a number of alternatives and provide valid values calculated from predetermined criteria.

ISSN : 2580-7250

2. Research Methodology

2.1. Data Collection

The data collection method used in discussing this thesis is the Observation Method through careful observation and recording of phenomena. This method requires direct or indirect observation of the research object being carried out. The results that have been obtained from observations of the phenomena that occur, namely that so far decision making at SMK Negeri 4 Medan has not been very effective and efficient because it is still manual in its policies.

2.2. Needs Analysis

This stage is a needs analysis to determine what kind of software you want to produce. The needs analysis in this research is as follows:

a. Needs Analysis (Input)
   Stages of analysis of input needs, which are determined by research conducted by the author at this stage. The input requirements entered are data information from potential scholarship recipient users for selection.
b. Needs Analysis (Output)
   Can provide output in the form of identification in the form of the sentences "Scholarship Awarded" and "Not Awarded"

2.3. Planning

This system was built so that users can use it to make decisions regarding fair distribution, and the results will help the parties involved in making the right decisions.

a. Database Design

The stages of designing a database are necessary for the needs of the system being built. If the database is designed incorrectly it will cause system failures or bugs. This stage is an important stage because it is a smooth process for the application being built

b. Interface Design

Interface design is the stage of creating an application display that will make it easier for us to use the application being built. In this way, the appearance of the application is easy to understand and attractive, becoming a reference for the author

2.4. Testing

System testing will be carried out to determine students' eligibility to receive scholarship assistance. This test was carried out using student data that had been collected by the school.

2.5. Application

Because the distribution of scholarships at SMK Negeri 4 Medan still uses manual methods, this research was carried out by inputting student data that had been collected to identify problems that arise in the process of determining the ranking of prospective scholarship recipients using the Fuzzy Logic Tsukamoto Method. To identify these problems, data is needed to determine the ranking of prospective scholarship recipients.

3. Results and Discussion

3.1. Data analysis

At this stage, the analysis needed to create a decision support system for selecting scholarship recipient students is carried out using the Tsukamoto fuzzy logic method. Fuzzy system analysis, software analysis.

a. Fuzzy system analysis

In this research, five membership functions were used, namely parental income, parental dependents, number of siblings, non-academic achievement, cumulative value and scholarship category. Where 5 input variables are used, namely parent's income,

parent's dependents, number of siblings, non-academic achievement, cumulative value to determine the scholarship category that will be received by website-based scholarship recipients.

b. Software Analysis

In this research, software was used to support the creation of this research program, consisting of Visual Studio code which was used as a code editor, and MySQL as a website data base.

3.2. Fuzzyfication

Fuzzyfication is input whose truth value is definite (crips input) converted into fuzzy input, which is a linguistic value based on a membership function. At this stage, the input value is the value of each input variable consisting of the parent's salary, the number of parent's dependents, the number of siblings, non-academic achievements and cumulative grades.

Table1. Criteria Weight Value

Input	Parents' Salary	Low	0≤2000.000
		Medium	2.000.000≤6.000.000
		High	≥6000.0000
	Number of Parental Dependents	Low	0≤ 2
		Medium	2 ≤ 6
		High	≥6
	Number of Siblings	Low	0≤ 3
		High	3≤6
	Number of Siblings	Low	0≤ 2
		High	≥3
	Number of Siblings	Low	5≤7
		High	6≤ 10
	Number of Siblings	Didn't get a scholarship	0≤5
		Scholarships Awarded	5< 10

3.3. System implementation

System implementation is a continuation of the system analysis and design stage. This system is designed using the PHP programming language and uses a MySQL database

a. Login Page View

Before further access the user is required to log in. The login page is specially designed for Administrators and Users access. If the user has registered, the user can immediately enter the username or email and password data into the login form and press the login button. If the username and password are “incorrect”, then it will not go to the profile page, but if the username and If the password is “correct”, it will go straight to the home page.

Figure 1. Login page view

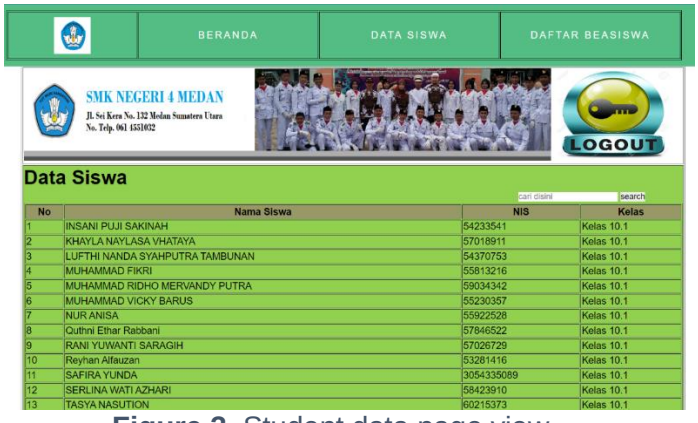
b. Home page

This home page for entering data such as student data input displays Home, Student Data. And scholarship acceptance displays the scholarship criteria that have been determined according to the data input data. While the output displays a report, namely the report received by the new scholarship acceptance which functions to find out who is accepted to get a scholarship, the recommendation report is the result of calculating with fuzzy logic. Finally, the sub menu for exiting which displays data on the choice of leaving or not from the SPK application This is the most important menu, where in this sub menu there is a sub menu for entering data on officers, applicants, for more clarity, it can be seen in the figure below. can be seen in the picture below.

Figure 2. Home page view

c. Student data page view

The main sub menu contains the student data menu. In this student data sub menu displays the data to be entered, namely Nis, student name, and class. If there is an error, it is enough to click the edit button, if we want to correct the data, just press the delete button. we want to correct the data results, just press the delete button to delete the data we want. delete the data we want. To exit this student data entry menu we simply click the back button and we will return to the main menu, for more details we can see in the image below.



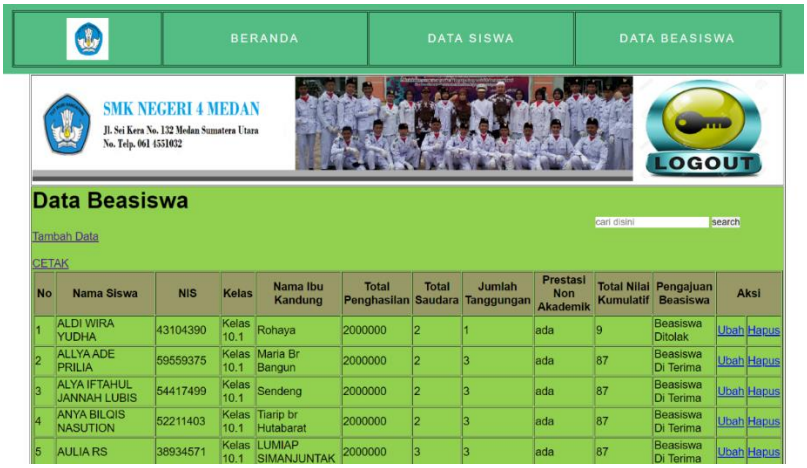
No	Nama Siswa	NIS	Kelas
1	INSANI PUJI SAKINAH	54233541	Kelas 10.1
2	KHAYLA NAYLASA VHATAYA	57018911	Kelas 10.1
3	LUFTHI NANDA SYAHPUTRA TAMBUNAN	54370753	Kelas 10.1
4	MUHAMMAD FIKRI	55813216	Kelas 10.1
5	MUHAMMAD RIDHO MERVANDY PUTRA	59034342	Kelas 10.1
6	MUHAMMAD VICKY BARUS	55230357	Kelas 10.1
7	NUR ANISA	55922528	Kelas 10.1
8	Quthni Ethar Rabbani	57846522	Kelas 10.1
9	RANI YUWANTI SARAGIH	57026729	Kelas 10.1
10	Reyhan Alfauzan	53281416	Kelas 10.1
11	SAFIRA YUNDA	3054335089	Kelas 10.1
12	SERLINA WATI AZHARI	58423910	Kelas 10.1
13	TASYA NASUTION	60215373	Kelas 10.1

Figure 3. Student data page view

d. Scholarship data page view

The main submenu contains the Scholarship Data menu. On the Scholarship Data Submenu The Scholarship Data submenu displays the data to be filled in, namely Nis, Student Name, Biological Mother's Name, Total Siblings, Total Parental Income, Total Siblings. In this case, entering the scholarship data is not difficult, just click the Add button in the menu and it will display an empty text box ready to be filled in, if we feel

that all the data we entered is correct then we just need to save the data by clicking the Save button. If there is an error, just click the edit button, if we want to correct the data results, just press the delete button to delete the data we want. To leave this student data entry menu we just click the back button and we will return to the main menu, for more details we can see in the picture below.



No	Nama Siswa	NIS	Kelas	Nama Ibu Kandung	Total Penghasilan	Total Saudara	Jumlah Tanggungan	Prestasi Non Akademik	Total Nilai Kumulatif	Pengajuan Beasiswa	Aksi	
1	ALDI WIRA YUDHA	43104390	Kelas 10.1	Rohaya	2000000	2	1	ada	9	Beasiswa Ditolak	Ubah	Hapus
2	ALLYA ADE PRILIA	59559375	Kelas 10.1	Maria Br Bangun	2000000	2	3	ada	87	Beasiswa Di Terima	Ubah	Hapus
3	ALYA IFTAHUL JANNAH LUBIS	54417499	Kelas 10.1	Sendeng	2000000	2	3	ada	87	Beasiswa Di Terima	Ubah	Hapus
4	ANYA BILQIS NASUTION	52211403	Kelas 10.1	Tiarip br Hutabarat	2000000	2	3	ada	87	Beasiswa Di Terima	Ubah	Hapus
5	AULIA RS	38934571	Kelas 10.1	LUMIAP SIMANJUNTAK	2000000	3	3	ada	87	Beasiswa Di Terima	Ubah	Hapus

Figure 4. Scholarship data page view

e. Program Output

The output of the program contains the results of recommendations for students. which contains the results of calculations using fuzzy logic which consists of consisting of: criteria for outstanding scholarship scholarship reports, as well as assessment reports acceptance of the scholarship whether it will be granted or deferred so that we can see it as shown below.

DATA LAPORAN BEASISWA

SMKS MUHAMMADIYAH 9

No	Nama Siswa	NIS	Kelas	Nama Ibu Kandung	Total Penghasilan	Total Saudara	Jumlah Tanggungan	Prestasi Non Akademik	Total Nilai Kumulatif	Pengajuan Beasiswa
1	ABDUL RIZKI	35286975	Kelas 10.1	Almh. Supini	2000000	2	3	ada	85	Beasiswa Di Terima
2	ALDI WIRA YUDHA	43104390	Kelas 10.1	Rohaya	2000000	2	3	ada	87	Beasiswa Di Terima
3	ALLYA ADE PRILIA	59559375	Kelas 10.1	Maria Br Bangun	2000000	2	3	ada	87	Beasiswa Di Terima
4	ALYA IFTAHUL JANNAH LUBIS	54417499	Kelas 10.1	Sendeng	2000000	2	3	ada	87	Beasiswa Di Terima
5	ANYA BILQIS NASUTION	52211403	Kelas 10.1	Tiarip br Hutabarat	2000000	2	3	ada	87	Beasiswa Di Terima
6	AULIA RS	38934571	Kelas 10.1	LUMIAP SIMANJUNTAK	2000000	3	3	ada	87	Beasiswa Di Terima
7	BAGAS PRATAMA	66920558	Kelas 10.1	Longsi Br Sembiring	2000000	2	3	ada	87	Beasiswa Di Terima
8	CINDY SEPTIANI	58440818	Kelas 10.1	Lumiana Simanjuntak	2000000	2	3	ada	87	Beasiswa Di Terima
9	DEANDRA QIAN AZIZI	51972785	Kelas 10.1	LELEH BR. TARIGAN	2000000	2	3	ada	87	Beasiswa Di Terima
10	EDU ADRIANSAH	47570211	Kelas 10.1	Shempi Sinaga	2000000	2	3	ada	87	Beasiswa Di Terima
11	ELAN ADLY YUDHISTIRA	52078601	Kelas 10.1	Perpi Sianturi	2000000	2	2	ada	87	Beasiswa Di Terima
12	FAIRUZ AZZARIA SIREGAR	60251970	Kelas 10.1	Linggem Br Karo	2000000	2	2	ada	87	Beasiswa Di Terima
13	ADE PUTRI SINODESTA SITUMEANG	52238753	Kelas 10.10	Rantai Malem Br Sembiring	2000000	2	2	ada	87	Beasiswa Di Terima
14	AGUNG FORTINO DAELY	52524915	Kelas 10.10	Esmalina Silalahi	2000000	2	2	ada	87	Beasiswa Di Terima
15	ALFIAN NUGRAHA	51942811	Kelas 10.10	Hernia Sinaga	2000000	2	2	ada	87	Beasiswa Di Terima
16	AMOS REZA PURBA	28907323	Kelas 10.10	Sadaukur Br Purba	2000000	2	2	ada	85	Beasiswa Di Terima
17	ANATAZA NURUL QOTIMAH	38680353	Kelas 10.10	pamah br singarimbun	3500000	2	3	ada	85	Beasiswa Ditolak
18	BRIANT ANDREAS PANGARIBUAN	52556109	Kelas 10.10	Bunga Br Karo	3500000	2	3	ada	85	Beasiswa Ditolak

Figure 5. Program Output

3.4. Discussion

The application of existing methods on websites and applications, namely:

a. Planning: At this stage the research process is carried out in several stages, namely data collection, fuzzy implementation, system testing, and conclusion formulation.
b. Data Collection Techniques: The data collection method used in the discussion of this thesis is to use: Observation method through observation and recording of the phenomenon being studied.

c. Needs Analysis: In this stage is a needs analysis to determine what kind of software you want to produce.
d. Design: This system is built to be used by users in decision making, in fair distribution, and the results will help related parties in making the right decision. in making the right decision
e. Testing: System testing will be carried out to determine the eligibility of students to receive scholarship assistance. This test is carried out using student data that has been collected by the school.
f. Implementation: This study was conducted by inputting student data that has been collected to identify problems that arise in the process of determining the ranking of prospective student scholarship recipients using the Tsukamoto Method Fuzzy Logic.

4. Conclusion

Based on the results of testing and data analysis that has been done, the following conclusions can be drawn, this decision support system has successfully implemented the Tsukamoto fuzzy method which is used for the selection of scholarship recipients. Factors that affect the test results using this Fuzzy Tsukamoto method are parents' income, the number of student siblings, non-academic achievements, good cumulative grades, the amount of dependents owned by parents. the number of dependents owned by the student's parents. Decision Support System with Tsukamoto fuzzy method has been made according to the design and can be used in recommending prospective students. according to the design and can be used in recommending prospective scholarship recipients in making decisions.

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