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Decision Support System for Determining Doctoral Scholarship Recipients at STMIK Pelita Nusantara with the Topsis Method

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ABSTRACT

This research is a decision support system for determining S3 scholarship recipients at STMIK Pelita Nusantara with TOPSIS method. The TOPSIS method is used for determining S3 scholarship recipients that are determined based on criteria. This decision support system was built with Visual Studio 2010 application as a tool for determining S3 scholarship recipients at STMIK Pelita Nusantara and using MYSQL as a database. The result of this decision support system is to produce an objective and systematic decision support system in determining the S3 scholarship recipients with the best qualifications. This system aims to help the foundation in selecting lecturers who are eligible to get a S3 scholarship at STMIK Pelita Nusantara.

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1. INTRODUCTION

Scholarships are grants in the form of financial assistance provided by the government, universities and educational or research institutions, especially STMIK Pelita Nusantara providing scholarships to lecturers to improve the quality of lecturers in expanding their knowledge according to the field of study of lecturers [1] [2].

STMIK Pelita Nusantara as one of the higher education institutions that seeks to improve the quality of education. To get a science, it is necessary to have further studies to a higher level, therefore scholarships play a very important role in the expansion of educational knowledge.

STMIK Pelita Nusantara is a higher education institution under the auspices of the Cemerlang Democratic Education Foundation which provides scholarships to educators (lecturers) to increase the level of education to the master's degree program and doctoral degree program. To get the scholarship, it is necessary to meet the requirements and criteria that must be met in accordance with the rules that have been set.

Doctoral program scholarships are given to improve the quality of lecturers in expanding appropriate knowledge in the field of lecturer study [3] [4]. In the field of education, of course,

academic staff is ranked first in the priority scale of coaching and development. The criteria for awarding scholarships for the Doctoral program include the length of teaching, position, field of science, discipline, rank [5] [6].

The provision of doctoral scholarships at STMIK Pelita Nusantara is still based on the Foundation's assessment in accordance with existing needs and opportunities. Scholarships are not given based on standard or standard rules. Scholarships are limited by the amount of funds provided. Scholarships are still not implemented in a systematic manner. The number of lecturers who are interested in further study of the S3 scholarship, the management of the Foundation as the manager of STMIK Pelita Nusantara finds it difficult to determine the recipient of the S3 scholarship. So that determining the eligibility of scholarship recipients takes a long time, therefore a system is needed to assist the Democrat Cemerlang Foundation in determining lecturers who are eligible to receive doctoral scholarships.

The method used in this decision support system is the TOPSIS method because it can determine the weight value for each attribute [7] [8] [9]. The TOPSIS method is a decision support method that is based on the concept that the best alternative not only has the shortest distance from a positive ideal solution, but also has the longest distance from a negative ideal solution which in this case will provide recommendations for S3 scholarship recipients as expected [10] [11] [12].

According to Sachdeva in Marbun and Sinaga (2018:21) TOPSIS is one of the multi-criteria decision-making methods introduced by Yoon and Hwang (1981) [13]. To be used as a method in solving multi-criteria problems. TOPSIS provides a solution from a number of possible alternatives by comparing each alternative with the best alternative and the worst alternative among the alternative problems [14] [15]. This method uses distance to perform the comparison.

Yoon and Hwang developed the TOPSIS method based on intuition, namely the alternative choice is an alternative that has the smallest distance from the positive ideal solution and the largest distance from the negative ideal solution from a geometric point of view using the Euclidean distance [16]. However, the alternative which has the smallest distance from the positive ideal solution, does not necessarily have the largest distance from the negative ideal solution. Therefore TOPSIS considers both, the distance to the positive ideal solution and the distance to the negative ideal solution simultaneously. The optimal solution in the TOPSIS method is obtained by determining the relative proximity of an alternative to the positive ideal solution.

Unified Modeling Language (UML) is an industry standard language for visualizing, designing, and documenting systems. UML offers a standard for designing a system model [17] [18]. By using UML we can create models for all types of software applications, where these applications can run on any hardware, operating system and network and are written in any programming language. But because UML also uses classes and operations in its basic concept, it is more suitable for writing software in object-oriented languages such as C++, Java, C#, or VB.NET. However, UML can still be used for modeling procedural applications in VB or C.

2. RESEARCH METHODS

In obtaining the data, several methods have been used in order to obtain data in accordance with the research needs. The methods referred to in this research are: observation method; interview method and literature method.

2.1 System Requirements Analysis

Needs analysis is the decomposition of a complete information system into its component parts with a view to identifying and evaluating problems. The system requirements analysis stage is a very important initial stage in building a system because this will greatly affect the system to be built. Based on the results of the ongoing system analysis, the proposed system is to utilize the sophistication of computer technology in making a fast, precise and accurate decision support system using the TOPSIS method. So that it will make it easier for STMIK Pelita Nusantara in determining the lecturers who are entitled to receive S3 scholarships.

2.2 Description TOPSIS

The steps in determining the recipients of S3 scholarships with the TOPSIS FMADM method can be seen in the flow chart below:

a. Build a normalized decision matrix. The rij element is the result of normalized decisionmatrix R using the Euclidean method the length of a vector is

$$rij = \frac{X_{ij}}{\sqrt{\sum_i^m = xij^2}} \quad (1)$$

Where :

rij = result of normalization of decision matrix R

i = 1,2,...,m;

j = 1,2,...,n;

b. Build a weighted normalized decision matrix with weights W- (w1, w2,... , wn)

vij = wi * rij..... (2)

c. Determine the positive ideal solution and the negative ideal solution. The positive ideal solution is denoted by A+ and the negative ideal solution by A- is as follows:

A+ = {(max vij) (min vij | j ?J'), i = 1,2,3,...,m} = {v1+, v2+, ... vm+}..... (3)

A- = {(max vij) (min vij | j ?J'), i = 1,2,3,...,m} = {v1-, v2-, ... vm-}..... (4)

d. Calculating Separation, this Separation Measure is a measurement of the distance from an alternative to a positive ideal solution and a negative ideal solution. The mathematical calculations are as follows:

Unified Separation measure for positive ideal solution

$$S_I^+ = \sqrt{\sum_{j=1}^n (v_{ij} - v_{ij}^+)^2} \text{ with i = 1,2,3,...,m} \quad (5)$$

Separation measure for positive ideal solutions

$$S_I^- = \sqrt{\sum_{j=1}^n (v_{ij} - v_{ij}^-)^2} \quad (6)$$

e. Calculates relative closeness to the ideal solution. The relative closeness of alternative A+ to the ideal solution A- is represented by:

$$C_i = \text{ with o< Ci+ < 1 and i = 1,2,3,..,m} \frac{s_i^-}{s_i^- + s_i^+} \quad (7)$$

f. Alternative ranking. Alternatives can be ranked in order of Ci+. Alternative with Ci+ value. biggest is the best solution.

3. RESULTS AND DISCUSSION

3.1 System Implementation

Implementation is the stage where the system or application that is ready to be operated in actual conditions is in accordance with the results of the analysis and design carried out, so that it will be known whether the system or application designed can actually produce the achieved goals. The decision support system application is equipped with a graphical interface that aims to make it easier for users to use it. The function of this interface is to provide input and display output from the application.

a. Software Requirements

The software used to run this application is the Windows 8 Operating System (OS), the Visual Studio 2010 programming language, and the MYSQL database.

b. Hardware Requirements

In building this application, hardware specifications play a very important role in the performance of the decision support system. In making this system, there are minimum requirements for the hardware used so that system performance can be more optimal. The hardware requirements used in building the Decision Support System Application are: Intel 1.8 GHZ Processor; Memory 2048 MB RAM; 500 GB hard drive; 14 inch LCD monitor; Keyboard and Mouse.

2.2 System Implementation Stages

System implementation is the stage of implementing the system that will be carried out if the system is approved, including programs that have been made at the system design stage so that it is ready for operation.

a. Login form

The login form display is a view where the admin performs the registration process before entering the admin menu:

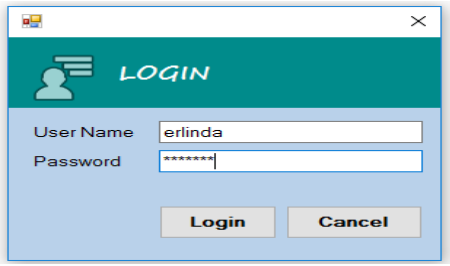


Figure 1. Login Form

The login screen above is the display that will appear if an admin wants to enter the administrator's home page.

b. Main Menu Display

The main menu display is the first page that appears when the admin accesses the decision support system page for determining the recipient of the S3 scholarship at STMIK Pelita Nusantara. In the main part of this page there are Input, Process and Results menus.

Figure 2. Main Menu Form

c. Criteria Data Input Form

In the input criteria data form for scholarship recipients, where the admin inputs the criteria code, criteria name, criteria description, criteria weights, C1, C2, C3, C4 C5 are directly stored in the database.

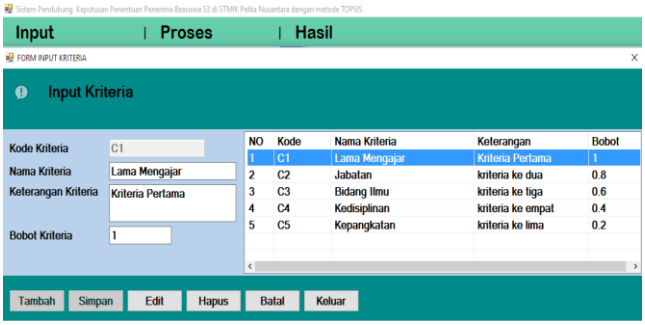


Figure 3. Criteria Data Input Form

d. Fuzzy Conversion input form

In the fuzzy conversion input form, where the admin can input, the criteria code, the weight of the fuzzy number criteria, and directly stored in the database.

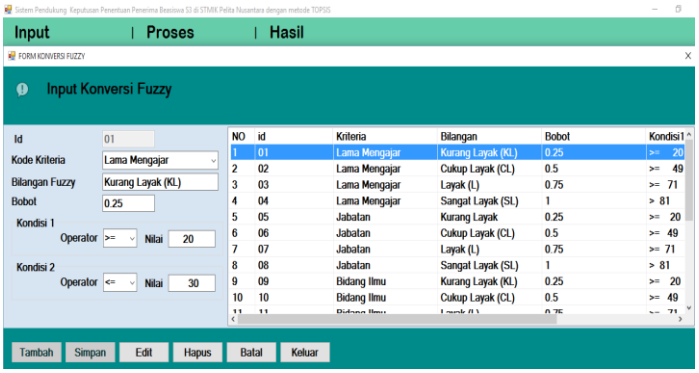


Figure 4. Fuzzy Conversion Input Form

e. Alternative Input

In the alternative input form, where the admin can input, alternative code, name, length of teaching, position, field of knowledge, discipline, rank, and admin can add, delete, edit if there is an error in data input, and will be given a value for each criterion.

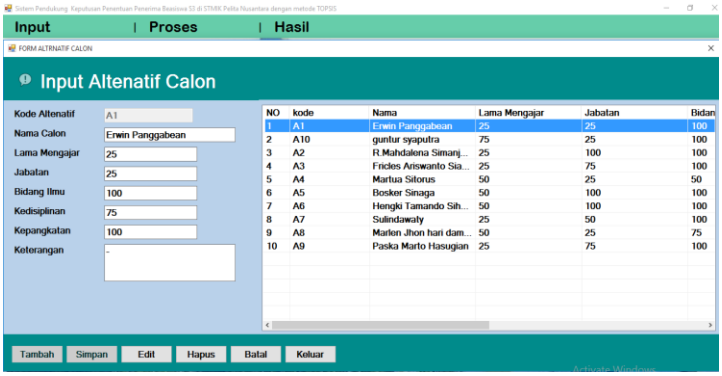


Figure 5. Alternative Input Form

f. TOPSIS Process Form Display

In the TOPSIS process form, a weighted matrix is displayed, this form displays the value of the negative ideal solution and the positive ideal solution.

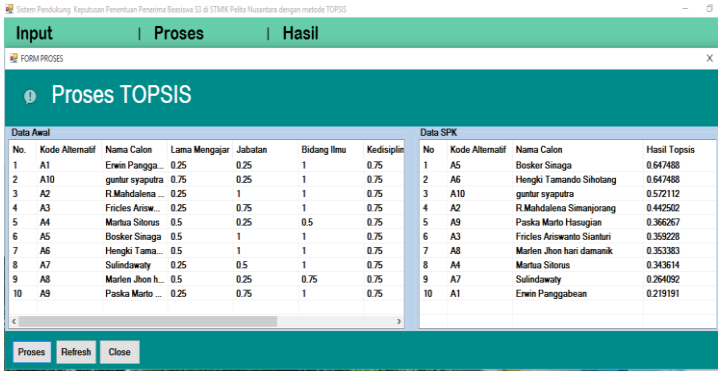
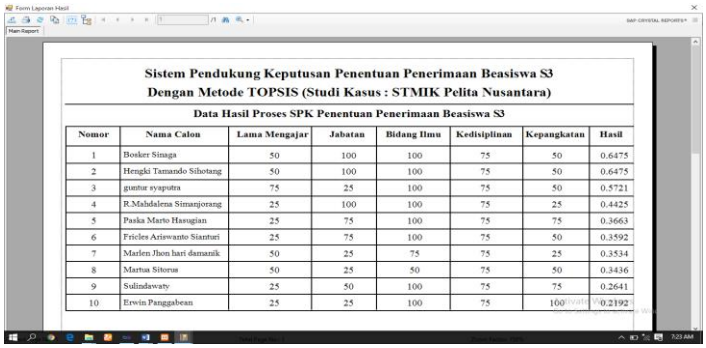


Figure 6. Process Form

g. Report Results

This view displays a table and the results of the overall report printing by the user by the decision support system, and the highest score will win the scholarship recipient. The display of the report form can be seen in the image below:



Sistem Pendukung Keputusan Penentuan Penerimaan Beasiswa S3
Dengan Metode TOPSIS (Studi Kasus : STMIK Pelita Nusantara)

Data Hasil Proses SPK Penentuan Penerimaan Beasiswa S3

Nomor	Nama Calon	Lama Mengajar	Jabatan	Bidang Ilmu	Kedisiplinan	Kepangkatan	Hasil
1	Bosker Sinaga	50	100	100	75	50	0.6475
2	Hengki Tamando Sihotang	50	100	100	75	50	0.6475
3	guntur syaputra	75	25	100	75	50	0.5721
4	R.Mahdalena Simanjorang	25	100	100	75	25	0.4425
5	Paska Marto Hasugian	25	75	100	75	75	0.3663
6	Fricles Ariswanto Sianturi	25	75	100	75	50	0.3592
7	Marlen Jhon hari damanik	50	25	75	75	25	0.3534
8	Martua Sitorus	50	25	50	75	50	0.3436
9	Sulindawaty	25	50	100	75	75	0.2641
10	Erwin Panggabean	25	25	100	75	100	0.2192

Figure 7. Report Result Form

In the display above is the display of the report form generated from the proximity value process.

4. CONCLUSION

The following are some conclusions from the implementation and research that has been made: To analyze the decision support system in determining the recipients of the doctoral scholarship, an alternative and criteria for assessment are needed. Application The decision support system that was built applies the TOPSIS method to make it easier for the foundation to make decisions for lecturers who are eligible to receive doctoral scholarships. This decision support system is able to display the highest calculation results using the TOPSIS method.

REFERENCES

[1] V. W. Sari, "PENGARUH PERENCANAAN STRATEGIS DAN TRANSPARANSI TERHADAP KINERJA LEMBAGA LAYANAN PENDIDIKANTINGGIWILAYAH ISUMATERA UTARA." 2018.

[2] S. E. Sri Suryaningsum, S. E. Rakyan Widhowati Tanjung, S. E. Berliana Kusumastutik, B. A. Bour, S. Ak, and S. E. Andre Juanda Limbong, *Strategi Pendanaan Penelitian pada Perguruan Tinggi untuk Meningkatkan Kinerja Penelitian*. Nugra Media, 2020.

[3] D. P. Nasional, "Ketentuan Umum." Jakarta: Departemen Pendidikan Nasional, 2003.

[4] C. Z. Harun and N. Usman, "PENGEMBANGAN KINERJA DOSEN FAKULTAS USHULUDDIN IAIN AR-RANIRY BANDA ACEH," *J. Adm. Pendidik. Progr. Pascasarj. Unsyiah*, vol. 1, no. 2, 2012.

[5] S. Muljana, "FAKTOR-FAKTOR PENGHAMBAT KENAIKAN PANGKAT PEJABAT FUNGSIONAL

ANALIS KEPEGAWAIAN PADA BADAN KEPEGAWAIAN NEGARA PUSAT SKRIPSI."

[6] S. MUTU, "UNIVERSITAS MUHAMMADIYAH BENGKULU STANDAR MUTU UNIVERSITAS MUHAMMADIYAH BENGKULU," *Univ. MUHAMMADIYAH BENGKULU*, p. 30.

[7] I. Muzakkir, "Penerapan metode topsis untuk sistem pendukung keputusan penentuan keluarga miskin pada desa panca karsa ii," *Ilk. J. Ilm.*, vol. 9, no. 3, pp. 274–281, 2017.

[8] L. N. Hidayat, "Metode TOPSIS Untuk Membantu Pemilihan Jurusan Pada Sekolah Menengah Atas," *Tugas Akhir Progr. Stud. Inform. Komputer, Univ. Dian Nuswantoro. Semarang*, 2014.

[9] A. Mubarok, H. D. Suherman, Y. Ramdhani, and S. Topiq, "Sistem Pendukung Keputusan Kelayakan Pemberian Kredit Dengan Metode TOPSIS," *J. Inform.*, vol. 6, no. 1, pp. 37–46, 2019.

[10] N. G. Perdana and T. Widodo, "Sistem Pendukung Keputusan Pemberian Beasiswa Kepada Peserta Didik Baru Menggunakan Metode TOPSIS," *Semant. 2013*, vol. 3, no. 1, pp. 265–272, 2013.

[11] F. Riandari, P. M. Hasugian, and I. Taufik, "Sistem Pendukung Keputusan Menggunakan Metode TOPSIS Dalam Memilih Kepala Departemen Pada Kantor Balai Wilayah Sungai Sumatera II Medan," *J. Inform. Pelita Nusant.*, vol. 2, no. 1, 2017.

[12] E. Kurniawan, H. Mustafidah, and A. Shofiyani, "Metode TOPSIS untuk Menentukan Penerimaan Mahasiswa Baru Pendidikan Dokter di Universitas Muhammadiyah Purwokerto," *JUITA J. Inform.*, vol. 3, no. 4, 2015.

[13] M. Marbun and B. Sinaga, "Sistem Pendukung Keputusan Penilaian Hasil Belajar Mahasiswa Dengan Metode Topsis Di STMIK Pelita Nusantara Medan," *J. Mantik Penusa*, vol. 1, no. 2, 2017.

[14] D. Arbian, "Sistem Pendukung Keputusan (SPK) Pemberian Beasiswa Berbasis TOPSIS (Studi Kasus Yayasan Pendidikan Al-Hikmah Bululawang Malang)," *J. Ilm. Teknol. Inf. Asia*, vol. 11, no. 1, pp. 29–44, 2017.

[15] F. A. Setyaningsih, "Analisis Kinerja Technique For Order Preference By Similarity To Ideal Solution (TOPSIS) Untuk Pemilihan Program Studi," *J. Inform. J. Pengemb. IT*, vol. 2, no. 2, pp. 43–46, 2017.

[16] F. Muthohhari, "Sistem Penunjang Keputusa Pemilihan Toga (Tanaman Obat Keluarga) Dengan Metode Topsis," 2016.

[17] Y. Rahardja, J. Presstiliano, and N. P. Astuti, "Analisis dan Perancangan Mobile-Banking dengan Menggunakan UML," *J. Teknol. Informasi, Aiti*, vol. 5, no. 2, pp. 101–200, 2008.

[18] A. C. Djamen, "Pembangunan Sistem Informasi Administrasi Perizinan (HO, SIUP/TDP, & MIKOL)(Studi Kasus: Kantor Unit Pelayanan Terpadu Satu Pintu Kab. Minahasa Selatan)," *Eng. Educ. Journal-E2J*, vol. 4, no. 3, 2018.