Thesis Topic Recommendation Using Simple Multi Attribute Rating Technique

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Abstract. The purpose of this study is to design information systems that can recommend the selection of final project (thesis) topics based on the competencies possessed by students. The analytical model integrated into this system is the Simple Multi Attribute Rating Technique (SMART), with student competency data taken based on the grade score of the subjects relevant to the selection of the final project theme clusters. The design of the information system in this study uses a prototype model, with the main stages consisting of needs analysis, design, testing, and evaluation. The system designed successfully runs well and can provide recommendations on the selection of thesis topics. This recommendation provided an overview of the strength of competencies that are superior to students what have relevance to the cluster of the thesis main topics.

1. Introduction

Every college student who finishing their study must be write the theses report. With writing the theses, the students are expected can be solve the case problem according with their study systematically and logically, based on accurate data and supported by correct analysis. In determining the theses topic, the students usually consult with lecturer or search the appropriate literature by themselves. However, the fact is students often have difficulty to determine their thesis topic. Based on preliminary observation, around 68% of students wrong in determining the research area that suitable with their interest and expertise, most of them just follow the trend of research area and theses topic [1]. This because of many students do not know their competency. Determining the wrong theses topic can inhibit and slowdown in finishing their theses, because the topic that they choose is not suitable with their competency or interest. To determine the right topic with student's interest, of course must be supported by student's competency.

The topics of TA that offered at the Department of Informatics Universitas Islam Negeri (State Islamic University) Sunan Gunung Djati Bandung were divided into four groups of expertise namely Data Management and Information Systems, Computer Systems and Distributed Computing, Programming and Software Engineering, and Computer Vision and Intelligent Systems. Without knowing self-competence, students will find it difficult to determine the topic of TA to be taken.

Decision support systems can help students to determine the topic of TA to be selected based on their competency. SMART method is a method in multi-attribute decision making. This multi-attribute

decision making technique is used to support decision makers in choosing several alternatives. Each alternative consists of a set of attributes and each attribute has values. This value is averaged on a certain scale. Each attribute has a weight that describes how important a particular scale is. This weighting and ranking are used to assess each alternative to obtain the best alternative [2].

The research objectives are designing a Decision Support System (DSS) that can anticipate discrepancies between academic abilities based on the achievement of values on Theses topics taken by Designing Application Systems that can use as a tool to determine the suitability of Theses topics taken to improve the quality of the study process.

2. Methodology

System development in research uses the prototype method. In the prototyping method, developers with users can interact with each other during the system creation process. In developing the DSS as recommendation system selection of thesis topics, developers and experts in the academic field can interact with each other to produce appropriate DSS. The general stages of prototype development consist of: needs analysis, designing, and testing, and evaluation.

The advantage of the software development approach model with the prototype method is that the software engineering paradigm is quite effective. The key factor is how to define the rules in the early part of system development, where all stakeholders must agree that the prototype is developed to act as a mechanism for defining requirements. Furthermore, the prototype can be ignored (at least in part) and the software is actually engineered by paying more attention to aspects of quality and capability of maintenance [3].

3. Result and discussion

Along with the development of the role of communication information technology that processes information to be on time and on target [2]. Information systems are a combination of information technology and people activities that use computerized technology [3], which is generally used to manage and support operations [4]. Information systems are systems that process data in an organized manner [5], information systems have a high flexibility that allows them to be developed into better systems [6]. Based on many research results, information systems have advantages in term of: good data accessibility [7], efficient in time [8], accurate [9], supporting decisions precisely [10], more economical [11], wide accessibility [12], improve user understanding [13], improve productivity [14], pre-set better data and information [15], and as data storage [16]. This research using Decision Support System (DSS) for thesis topic recommendation using Simple Multi Attribute Rating Technique (SMART).

3.1. Method SMART (Simple Multi Attribute Rating Technique)

SMART uses a linear additive model to predict the value of each alternative. SMART is a flexible decision-making method. SMART is more widely used because of its simplicity in responding to decision makers' needs and how to analyse responses. The analysis involved is transparent so that this method provides a high understanding of the problem and can be accepted by decision makers [4]. The equation used for the SMART model is presented in Eq. 1

$$u(a_i) = \sum_{j=1}^{m} w_j u_i(a_i), \quad i = 1,2,\dots m \tag{1}$$

Where:

- w_j is the j-criteria weighting value of the k criteria.
- u_{ij} is an alternative utility value i in criterion j.
- Decision selection is identifying which of the n alternatives has the greatest function value.

Calculates the normalization value of weight (Eq. 2)

$$w_i = \frac{wj}{\sum wj} \quad (2)$$

- w_j is the j criterion weight value.
- w_i is the i criterion weight value.

Calculate utility value (Eq. 3)

$$u_{ij} = w_{ij} * a_{ij} \quad (3)$$

- u_{ij} is the value of the j criteria for alternatives i.
- a_{ij} is the j-criteria value for alternatives i.
- w_{ij} is the criteria-j weight for alternatives i.

The steps of the SMART method are as follows:

- Step 1: Determine the criteria.
- Step 2: Determine alternatives.
- Step 3: Make a ranking of the importance of criteria
- Step 4: Give weights based on the most important criteria to weak criteria
- Step 5: Find the weighted average criteria based on the most important and weak important.
- Step 6: Give weights to each alternative based on each criterion.
- Step 7: Calculate the evaluation of each alternative using the formula.

3.2. Analysis and design

For example, on selection/ recommendation of Thesis topics using the SMART method (data presented in Table 1), with the following steps:

- Formulate a problem that is a topic recommendation Thesis
- Formulating Expertise Groups [Column (1)]
- Determine the criteria for each group of expertise used in the topic recommendations Thesis [Column (2)]
- Determine appropriate topic alternatives to enter the calculation phase
- Determine the weight for each criterion. [Column (3)]
- Normalizing the criteria weight [Column (4)]
- Enter the value of the student [Column (5)]
- Conversion of student grades into weight values [Column (6)]
- Determine the ulitivity weight of each group [Column (7)]
- Determine the superior competencies of students by reviewing for each main group (the aggregate value of the utility of each group of expertise)

Table 1. Utility weight calculation for thesis topic recommendation.

Thesis main topics	Relevant courses	Weight (w_j)	Weight Normalization (w_i)	Example		
				Score	Score Weight (a)	Utility Score (u)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Data Management and Information System	Database	2	0,22	B	75	16,67
	Database Practice	1	0,11	A	100	11,11
	Database System	2	0,22	A	100	22,22
	Database System Practice	1	0,11	C	50	5,56
	Information System	3	0,33	A	100	33,33
		9	1,00			**88,88**
Computer System and Distributed Computing	Computer organization and architecture	3	0,25	C	50	12,50
	Operating System	3	0,25	B	75	18,75
	Networking	2	0,17	B	75	12,50
	Networking Practice	1	0,08	B	75	6,25
	Distributed System	3	0,25	B	75	18,75
		12	1,00			**68,74**
Programming and Software Engineering	Basic Programming	2	0,07	B	75	5,55
	Basic Programming Practice	1	0,04	B	75	2,78
	Algorithm and Programming	2	0,07	B	75	5,55
	Algorithm and Programming Practice	1	0,04	B	75	2,78
	Data Structure	2	0,07	B	75	5,55
	Data Structure Practice	1	0,04	B	75	2,78
	Software Engineering	2	0,07	B	75	5,55
	Software Engineering Practice	1	0,04	B	75	2,78
	Object-oriented Programming	2	0,07	B	75	5,55
	Object-oriented Programming Practice	1	0,04	B	75	2,78
	Platform-based Application	2	0,07	B	75	5,55
	Platform-based Application Practice	1	0,04	B	75	2,78
	Web Development	2	0,07	B	75	5,55
	Web Development Practice	1	0,04	B	75	2,78
	Software Project	3	0,11	B	75	8,33
	Specific Domain Software Engineering	2	0,07	B	75	5,55
	Specific Domain Software Engineering Practice	1	0,04	B	75	2,78
		27	1,00			**74,93**
Computer System and Artificial Intelligent	Language and Automata Theory	3	0,17	B	75	12,50
	Strategy of Algorithm	3	0,17	A	100	16,66
	Human and Computer Interaction	3	0,17	C	50	8,33
	Artificial Intelligent	3	0,17	C	50	8,33
	Computer Graphic	3	0,17	A	100	16,66
	Multimedia	2	0,11	A	100	11,11
	Multimedia Practice	1	0,06	A	100	5,55
		18	1,00			**79,14**

3.3. Implementation

The implementation of the interface aims to make the interface and system functions in accordance with the previous design. In this section is described the interface results that have been made and their information.

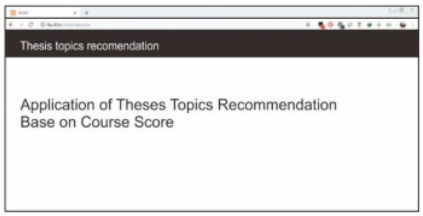

Figure 1. Main menu.

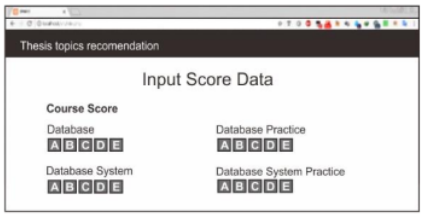

Figure 2. Input menu.

- Main Menu is the main page that is presented in this decision support system application. This page provides the calculation and implementation of the SMART method
- Input Menu provides the form to enter student lecture grade data that taken from the value of transcript. In this form the user enters data to be used in calculations
- Result Menu displays the value data of the course related to the topic of the final assignment, in order to review the value of the subjects that have been inputted.

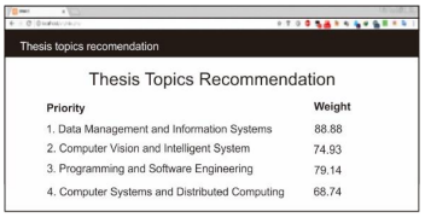

Figure 3. Result.

4. Conclusion

The system for a recommendation of selecting the final assignment (thesis) based on the acquisition of course values using the SMART method. The DSS can assist in providing suitable topics for students based on their competencies. The DSS reduces subjectivity and helps students to choose suitable Thesis topics.

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