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Decision Support System for Selecting Student Thesis Study Fields

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***Abstract*—** A thesis is a requirement for students to obtain an undergraduate degree. These requirements apply to the Department of Information Systems at the University of Tanjungpura. The first step in completing a thesis is to determine a title associated with the field of study, which is provided by the Department of Information Systems at the University of Tanjungpura. In the Information Systems Department, the process of determining the field of thesis study is done manually, leading to confusion and difficulty in selecting the appropriate field for students' theses. A decision support system has been developed to facilitate students in determining the field of study for their theses. The system utilizes the profile-matching method with the aim of providing mathematical and accurate recommendations for the thesis's field of study. The system testing employs the black box testing method.

***Keywords*—** Thesis Study, Decision Support System, Profile Matching, Black Box, Information System

I. INTRODUCTION

The thesis is a scientific paper that serves as the final project for undergraduate students. It is based on systematic and thorough research, and the work is supervised by two supervisors. The thesis is also a mandatory requirement for obtaining a bachelor's degree in all universities in Indonesia (Widiantoro, Nugroho, & Arief, 2019). Tanjungpura University is one of the institutions that implement thesis rules as a requirement for obtaining a bachelor's degree. However, many students, particularly in the Information Systems Department, still face confusion in working on their theses, especially when selecting the field of study.

The process of selecting the field of thesis study for students in the Tanjungpura University Information Systems Department is still done manually. This involves methods such as seeking advice from friends, searching for references from previous research, and consulting academic supervisors. However, the abundance of information obtained often leads to confusion and difficulties in determining the appropriate field of study for their theses. It is common for students to choose fields of study that are unrelated to the courses they have taken during semesters 1 to 7. This situation has a negative impact on the efficiency of thesis work and the quality of theses, as students lack a solid theoretical foundation due to choosing fields of study unrelated to the courses they have taken. Therefore, the implementation of a decision support system can assist students in selecting the appropriate field of thesis study. The profile matching method is used as the selection method in this system.

The profile matching method is used to compare the actual data value of a profile to be assessed with the expected profile value. It helps determine the difference in competence (GAP), where a smaller gap results in a higher weighted value. Consequently, a higher weighted value indicates a greater chance of being recommended for selection (Kurniawati & Ahmad, 2021). The Profile Matching method also involves grouping criteria based on core factors and secondary factors. These groupings are useful for establishing connections between courses and thesis study fields in the Information Systems Department. This ensures that the chosen thesis study fields align with the profiles of students in the Information Systems Department.

II. LITERATURE REVIEW

A. Information Systems of Tanjungpura University

According to Ministerial Decree Number 442/E.E2/DT/2014 dated 19 May 2014, the Information Systems Department/Program has implemented a Competency-Based Curriculum (KBK) since its establishment (TIM ICT MIPA, 2017). The curriculum of the Information Systems Study Program has a unique nature as it incorporates three fields: Management, Business, and Computer Science. Through these three disciplines, students will develop a diverse range of skills in information systems to fulfill organizational needs.

To evaluate the quality of students' abilities (competencies) in planning, designing, and building information systems independently, separate from the knowledge provided. The Information Systems Department assesses this through a thesis. The Information Systems Department, Faculty of Mathematics and Natural Sciences, Tanjungpura University, offers three areas of thesis study, namely: Management Information Systems Analysis and Design,

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Database Administration, and Application Development (TIM ICT MIPA, 2017).

B. Decision Support System

A decision support system is a system designed to provide solutions and facilitate communication in solving specific problems, using both structured and unstructured approaches (Aini, Hasmin, & Aisa, 2021). The decision support system (SPK) is developed with advanced capabilities, making it a valuable alternative in decision-making processes (Umar, Fadlil, & Yuminah, 2018).

The benefits of using SPK will be a faster solution with reliable results. It can effectively convince decision-makers of the decisions they make and provide a competitive advantage for the organization by saving time, effort, and costs (Satria, 2023).

C. Profile Matching

The profile matching method is a method used by assuming a level of predictor variables that meets the standard criteria required by research subjects, rather than the minimum level that must be met (Verdian & Wantoro, 2019). The following are the steps in the Profile Matching method.

1. Determine the weight value of each aspect to be used as the reference weight.
2. Map the gaps or differences by calculating the value of each aspect and grouping them.
3. Divide each criterion into two groups: core factors (NCF) and secondary factors (NSF). Calculate the NCF value using (1) and the NSF value using (2):

$$NCF = \frac{\sum NC(i,s,p)}{\sum IC} \quad (1)$$

Information:
NCF : The average value of the core factor
NC (i, s, p) : The total value of the core factor
IC : Number of core factor items

$$NSF = \frac{\sum NS(i,s,p)}{\sum IS} \quad (2)$$

Information:
NSF : The average value of the second factor
NS (i, s, p) : The total value of the second factor
IS : Number of second-factor items

4. The last stage of the profile matching method involves calculating the total score and ranking. This stage aims to provide recommendations for the previously calculated alternatives. Calculate the total value using equation (3).

$$(x)\%.NCF(i,s,p) + (x).NSF(i,s,p) = N(i,s,p) \quad (3)$$

D. Black Box Testing

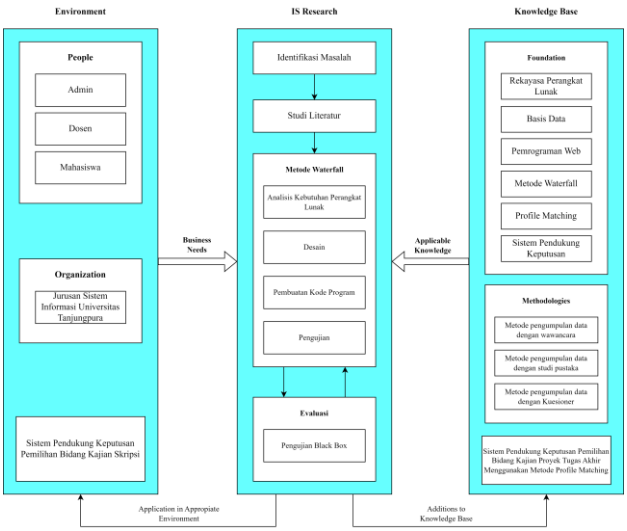
Testing a program is important to identify and rectify any errors, ensuring that potential losses resulting from these errors are avoided in the future. The black box testing method is employed to verify that every function in the system operates as per the design (Suseno, Iskandar, Novianty, Sahara, & Saifudin, 2022).

Black-box testing is performed to observe the execution results using test data and to verify the functionality of the system (Hanifah, Alit, & Sugiarto, 2016). It is based on customer requirements, making it easy to identify incomplete or unexpected requirements and correct them in the future (Murnane & Reed, 2001).

The black box method is a testing technique that involves observing the results of program execution and examining software functions (Zidan, Nur'aini, Wibowo, & Ulinuha, 2022). It can be compared to a black box, where we can only see the external aspects without knowing the internal contents. Similarly, black box testing is conducted by evaluating the system based on its outward appearance without considering the detailed internal processes (Arfani, Kasih, & Pamungkas, 2022).

III. RESEARCH METHOD

This research method utilizes a qualitative research approach with the objective of the design process, which simultaneously generates knowledge about the methods employed in designing an artifact and the design itself. (Abdurrasyid, Nugroho, Dakhlan, Arman, & Mahayana, 2022). The research methodology applies the IS Research framework from the Hevner Framework, which includes a description of the research environment, the stages carried out in the research, and the underlying knowledge used (Sitohang, Sari, & Febriyanto, 2021). The IS Research framework is illustrated in Picture 1.



Picture. 1. Research Framework

The following is the flow of stages conducted in the research.

1. Software Requirements Analysis

Software requirements analysis is the phase of analyzing the software requirements needed in the design, which includes examining documents and conducting literature studies.

2. Design

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Design involves creating the system design and depicting diagrams based on the analyzed requirements, as well as designing the system interface. The system design phase includes the creation of UML diagrams and the design of the system interface to be developed. The tools used during the design stage are draw.io and Figma.

3. Code Implementation

The program code creation stage involves implementing or coding the system design created during the system design stage. The coding process utilizes the Laravel framework, which is based on the PHP programming language. The code is written using a code editor, such as Visual Studio Code.

4. Testing

The testing phase involves conducting tests on the developed system and drawing conclusions regarding its success in meeting the intended requirements. System testing is performed using the black box method, which is divided into two parts: system functional testing and system interface testing.

IV. Result and Discussion

A. Implementation of Profile Matching Method

The profile matching method in the system serves as a calculation method used to analyze course grades. The following section describes the manual calculation process of the profile-matching method.

1. Determination of Course Grades

Determining course grades involves selecting grades based on the grades obtained by students throughout their courses from semester 1 to semester 7. The process of determining course grades can be seen in Table 1.

Table. 1. Determination of Course Values

Criteria	Sub Criteria	Course Grades
E-Business (P)	C+	4
Knowledge Management (P)	C	3
Open Source (P) Based System Administration	do not take	0
IT Quality Management (P)	do not take	0
IT Risk Management (P)	do not take	0
Corporate Application Integration (P)	do not take	0
E-Government (F)	B+	6
Information and Communication Technology	B+	6
Management and Organization	B+	6
Introduction to Information Systems	A	7
Network Design and Management	A	7
Customer Relationship Management	C	3
Information System Analysis and Design	B	5
Professional ethics	A	7
Software engineering	B	5
IS Project Management	B	5
Enterprise Architecture	B	5
Supply Chain Management	C	3
Research Methodology and Scientific Writing	A	7
IS/IT Strategic Planning	C	3
IS Governance and Audit	C	3
Practical Work / KKN	A	7
Decision Support System (P)	B+	6
Advanced Science Management (F)	do not take	0
Discrete Mathematics	B	5
Data Structure	C	3
Database	C+	4
Data Mining	B	5
Data Warehouses	A	7
Science Management	A	7
Statistics and Probability	B+	6
Linear Algebra	A	7
Health Information System (P)	do not take	0
Accounting and Financial Information System (P)	do not take	0
Multimedia (F)	A	7
Advanced GIS (P)	do not take	0
Introduction to Business	do not take	0
Algorithms and Programming	C+	4
English II	A	7
Web Programming I	A	7
Human and Computer Interaction	B	5
Object-oriented programming	A	7
Web Programming II	B+	6
Information System Development Project	A	7
Mobile Technology	A	7
Visual Programming	A	7
SIG	B+	6
Information Security	B+	6
Information Technology Entrepreneurship	B+	6
Smart Business	B+	6

2. Determination of Difference or Gap

The determination of differences or gaps involves subtracting the course grades from the standard profile scores, resulting in differences or gaps. These differences or gaps are then mapped to determine the corresponding values. The process of determining differences or gaps can be seen in Table 2.

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Table. 2. Determination of Differences or Gap

Course Grades	Default Profile Value	Gaps	Gap Value
4	7	-3	4
3	7	-4	3
0	7	-7	0
0	7	-7	0
0	7	-7	0
0	7	-7	0
6	7	-1	6
6	7	-1	6
6	7	-1	6
7	7	0	7
7	7	0	7
3	7	-4	3
5	7	-2	5
7	7	0	7
5	7	-2	5
5	7	-2	5
5	7	-2	5
3	7	-4	3
7	7	0	7
3	7	-4	3
3	7	-4	3
7	7	0	7
6	7	-1	6
0	7	-7	0
5	7	-2	5
3	7	-4	3
4	7	-3	4
5	7	-2	5
7	7	0	7
7	7	0	7
6	7	-1	6
7	7	0	7
0	7	-7	0
0	7	-7	0
7	7	0	7
0	7	-7	0
0	7	-7	0
4	7	-3	4
7	7	0	7
7	7	0	7
5	7	-2	5
7	7	0	7
6	7	-1	6
7	7	0	7
7	7	0	7
7	7	0	7
6	7	-1	6
6	7	-1	6
6	7	-1	6
6	7	-1	6

Table. 3. Calculation Result of NCF Values and NSF Values

Gap Value	Criteria Type	Average
4 3 0 0 0 0 6 6 6 7 7 3 5	Core Factor (60%)	1.86
7 5 5 5 3 7 3 3	Secondary Factor (40%)	5,27
7 6 0 5	Core Factor (60%)	3.00
3 4 5 7	Secondary Factor (40%)	5.50
7 6 7 0 0 7 0	Core Factor (60%)	1.75
0 4 7 7 5 7 6 7	Secondary Factor (40%)	5.79
7 7 6 6 6 6		

3. Calculation of NCF and NSF Values

The calculation of NCF and NSF values is performed to determine the resulting values for the core factor and secondary factor categories. Prior to calculating the NCF and NSF values, the differences or gaps for each alternative are divided into the core factor and secondary factor categories. The results of the NCF and NSF calculations, using Equation 1 and Equation 2, can be seen in Table 3.

4. Calculation of Total Value and Ranking.

The calculation of the total score and ranking is the final step in the profile matching method. The NCF and NSF values are calculated using Equation 2.3. The results of the total score are then used as a reference in determining the ranking to select an alternative field of thesis study. The results of the total value and ranking calculation can be seen in Table 4

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Table. 4. Calculation Result of Total Value

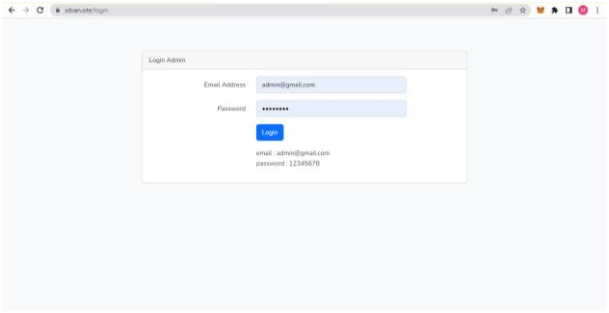
Gap Value	Criteria Type	NCF and NSF values	Total Value
4 3 0 0 0 0 6 6 6 7 7 3 5 7 5 5 5 3 7 3 3 7 6 0 5 3 4 5 7 7 6 7 0 0 7 0 0 4 7 7 5 7 6 7 7 7 6 6 6 6	Core Factor (60%) Secondary Factor (40%) Core Factor (60%) Secondary Factor (40%) Core Factor (60%) Secondary Factor (40%)	1.86 5,27 3.00 5.50 1.75 5.79	3,22 4.00 3,36

Based on the results of the calculations in Table 4, it can be concluded that the appropriate field of thesis study, based on the grades of the courses above, has the highest total score.

B. Implementation of User Interface Systems

1. Implementation of Login Interface

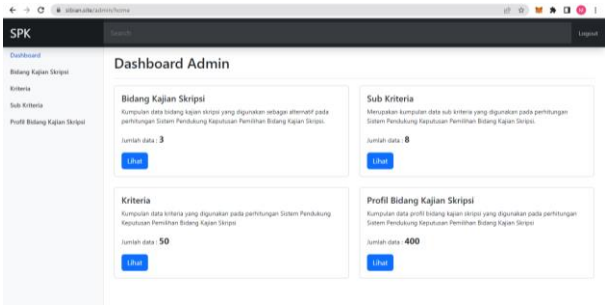
The implementation of login interface is an interface used by the admin to enter the system and process the data. The login process can be performed by users who already know the email and password. It can be seen in Picture 2



Picture 2 Implementation of Login Interface

2. Implementation of Admin Dashboard Interface

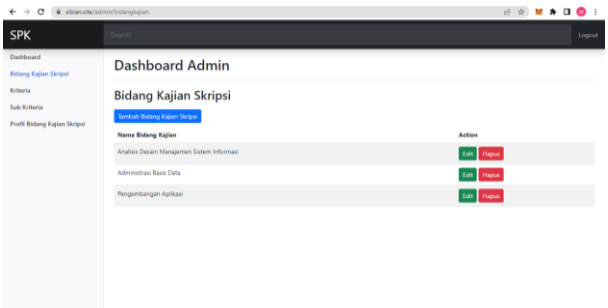
The implementation of the admin dashboard interface is the interface used by the user after successfully completing the login process. The system admin dashboard interface displays all the data within the system, including the total data owned by the system. It can be seen in Picture 3



Picture 3 Implementation of Admin Dashboard Interface

3. Implementation of Manage the Field of Thesis Study Interface

The implementation of the thesis study field management interface is used by the user to view comprehensive data related to the thesis study field. It provides the user with the ability to manage and manipulate the thesis study field data effectively. This interface can be observed in Picture 4.



Picture 4 Implementation of Manage The Field of Thesis Study Interface

4. Implementation of Manage Criteria Interface

The implementation of the Manage Criteria interface is used by users to manage criteria data. This interface provides functions for adding, editing, and deleting criteria data. You can refer to Picture 5 to see the visual representation of the interface.

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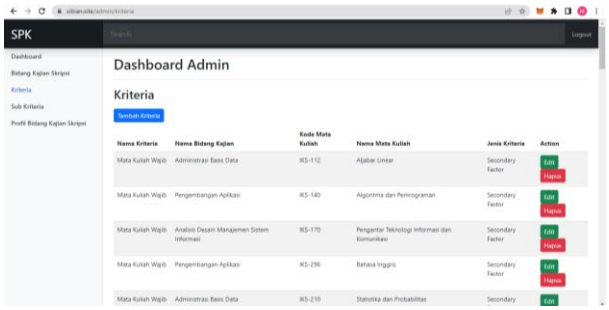
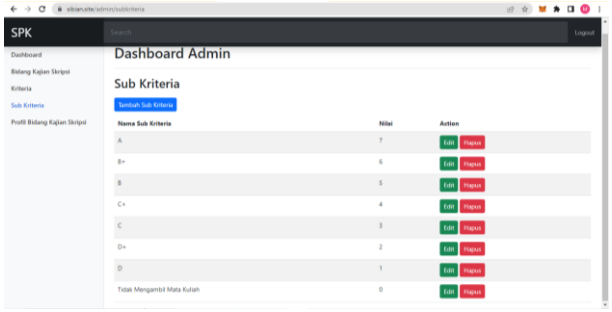


Picture 5 Implementation of Manage Criteria Interface

5. Implementation of Manage Sub-Criteria Interface

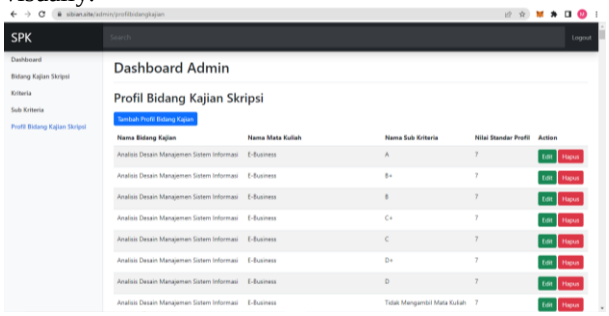
The implementation of the Manage Sub-Criteria interface is used by users to manage sub-criteria data. This interface is accessed when users want to manage the sub-criteria data. You can refer to Picture 6 to see the interface visual.



Picture 6 Implementation of Manage Sub-Criteria Interface

6. Implementation of Manage the Field of Thesis Study Profile Interface

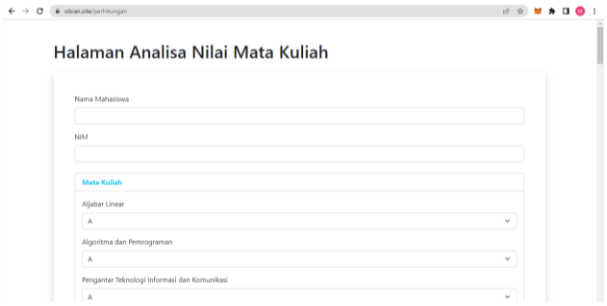
The implementation of the Thesis Review Field Profile Management interface is used to manage data related to the profiles of thesis study fields. This interface allows users to handle and organize the profiles effectively. You can refer to Picture 7 to see the interface visually.



Picture 7 Implementation of Manage The Field of Thesis Study Profile Interface.

7. Implementation of Course Value Analysis Interface

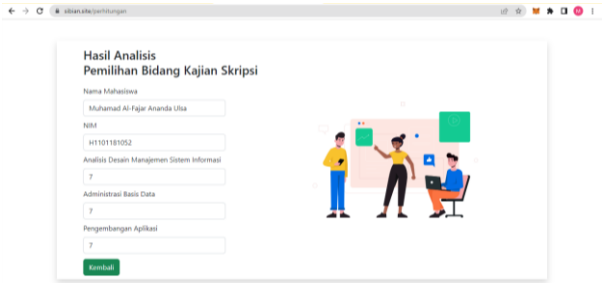
The Course Value Analysis interface is implemented to analyze course grades and determine the appropriate field of study based on the user's grades. This interface provides insights into the user's course performance and assists in decision-making regarding the field of study. You can refer to Picture 8 to view the interface visually.



Picture 8 Implementation of Course Value Analysis Interface

8. Implementation of Course Value Analysis Result Interface

In the Course Grade Analysis Results interface, the system presents the calculated results using the Profile Matching method. These results, displayed as numerical values, correspond to the fields of the thesis study and have been adjusted based on the user's course grades. It can be seen in Picture 9



Picture 9 Implementation of Course Value Analysis Result Interface

C. Test Result

The system functionality testing was conducted by two parties involved: the Department of Information Systems admin at Tanjungpura University and the Information Systems students at Tanjungpura University. This test was carried out with the aim of determining whether the system has been implemented according to the functional requirements and design specifications.

In the testing of the decision support system interface for selecting the field of thesis study, a comprehensive evaluation was performed in three aspects: software engineering, functionality, and visual communication. The evaluation process involved online testing using a Google questionnaire form, which was distributed through the WhatsApp application. A total of 30 respondents, who were students from the Information Systems Department at Tanjungpura University, actively participated in the test.

The evaluation results of the system interface testing revealed that the SIBIAN system achieved an impressive score of 85.3% based on the combined assessment of software engineering, functionality, and visual communication aspects. The score obtained places the system in the "Very Good" category, indicating its high level of performance and effectiveness.

V. CONCLUSION

The design and development of a decision support system application for selecting thesis study fields in the Information Systems Department using the Profile Matching method have proven to be beneficial. By utilizing this system, Information Systems students are assisted in making informed decisions based on their course grades. The system employs mathematical equations and follows a systematic approach, ensuring accurate and precise results according to the predefined criteria. Further research is recommended to explore the possibility of incorporating additional methods or combining multiple decision support system approaches to enhance the effectiveness and accuracy of the thesis study field selection process. This will contribute to the continuous improvement and advancement of the decision support system in the field of Information Systems

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