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Simple Additive Weighting Algorithm Implementation for Determining Supervisors in Student Final Project Information System

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ABSTRACT

The determination of the student supervisor for the final project at the Department of Electrical Engineering, State University of Malang, is determined by the Expertise Group and Study Program Coordinator. The determination is carried out and considered manually by both. It requires considerable time and effort, so the process is less efficient. Therefore, this study aims to develop an information system that can handle all processes related to the final project based on the Standard Operating Procedures applicable in the Department of Electrical Engineering, State University of Malang. This thesis and final project information system were developed using the Waterfall development model, which consists of four steps, namely: (1) Analyze; (2) Design; (3) Codes; and (4) Test. The method or algorithm applied to this information system is Simple Additive Weighting (SAW). Information systems experts and users test the system at every user access level. The tested data was obtained through a questionnaire. Based on the trials that have been carried out, the percentage results obtained are 100% for system validity by information systems experts, 97.41% for system validity by students, 93.75% for system validity by supervisors, 91.32% for system validity by members of Expertise Group, 100% for system validity by the Chair of the Expertise Group and Study Program Coordinator. The average percentage of trial results by all user access levels is 98.24%, indicating that the information system developed is considered valid and can be used by the University.

I. INTRODUCTION

Thesis and final project are things that students in undergraduate and diploma programs need to go through in order to complete their studies at universities. The work and preparation of the thesis and the final project is carried out with the guidance of the thesis and final project supervisor. The supervising lecturer should be a lecturer who masters the field of expertise that is in accordance with the concept or topic of the thesis title or final project submitted.

The supervising lecturer has obligations and responsibilities to the students he guides by checking and also providing direction to students. The process of determining the thesis supervisor and final project in the Department of Electrical Engineering, State University of Malang is carried out conventionally by the Expertise Group (KBK) and also the study program coordinator (Kaprodi). The selection of supervisors by KBK is based on several criteria. According to one member of the System and Media KBK for TVET, there are three criteria to determine the supervisory lecturers, namely: (1) the rank and class of lecturers; (2) the suitability of the title with the lecturer's field of expertise; (3) the number of students under the guidance of the lecturer. The selection of supervisors which is done manually by taking into account the three criteria takes a long time because it is necessary to pay attention to the suitability of each criterion with the title of the thesis or final project submitted and the supervisor.

Based on the description above, we need a system that can help take into account any existing criteria by paying attention to the title of the proposed thesis or final project in order to provide recommendations more quickly and appropriately in providing recommendations for thesis or final project supervisors. To meet these needs, a thesis and final project information system was built that has the ability to recommend supervisors.

The intelligent system was developed using an algorithm in order to solve the problem of selecting a supervisor. The algorithm used in the system is Simple Additive Weighting (SAW) which is a method or algorithm to make an assessment based on the weighting of predetermined criteria.

The advantage of the SAW method compared to other decision-making models lies in the ability of this method to make an accurate assessment through the value of the criteria and preference weights that have been determined. The SAW algorithm in the developed decision support system plays a role in ranking and selecting the best alternative from a number of given alternatives.

II. METHODS

Software product development that is carried out requires a development model to determine the steps and product development references. The development model used is the Waterfall model. The waterfall model is a software life cycle that has a process that resembles a straight line and is like a series [1]. Based on this understanding, the waterfall model is a model related to the life cycle of a software in a linear and sequential manner. Each stage in a software development must be completed before proceeding to the next stage of development. The flow chart of the waterfall development model used is shown in Fig. 1. Based on Figure 1, there are 4 stages of software development with the waterfall method. The stages or development steps consist of:

A. Analysis

This stage is the initial communication stage to software users regarding features that can later be used in a developed software. The features needed are divided into several levels of access, namely the access level of students, KBK members, KBK chairman, study program coordinators, and supervisors.

B. Design

The design stage is the initial process of working on a software after the analysis stage is completed. The design stage requires the developer to determine the process flow to the selection of the algorithm used in the software being developed. The final results obtained from this stage are: (1) Use Case Diagram which is a model of behaviour of an information system that will be made [2]; (2) Entity Relationship Diagram which is a form of relationship of activities in the information system that are related and have certain functions in the process [3]; (3) Data Flow Diagram which is a logical modelling of the data or processes performed on the data [4]. In addition to these three things, at this stage the initial design of the software to be developed is also made.

C. Code

The Code stage or the coding stage is the implementation stage of the design that has been made into a software program code with a certain programming language. The coding stage is carried out to change the results obtained at the design stage into a software that is starting to appear and is ready for testing.

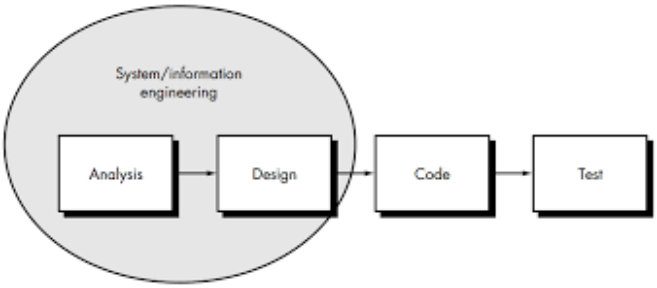

Fig. 1. The Waterfall model diagrams

D. Test

The Testing stage or the trial stage is the final stage in the process of making an information system or software. After the stages of analysis, design and coding or implementation are carried out, the software developed must be able to be used by users. The testing stage is a stage carried out to test all the functions contained in the software developed, so that the software made is free from errors and is in accordance with the needs that have been defined by software users in the previous stages [5]. The subjects used in the trial phase of the Thesis Information System and this Final Project consist of several groups, namely Information System Experts and Students. Information Systems Expert, namely a lecturer from the Department of Electrical Engineering, State University of Malang. Students, namely students of the Department of Electrical Engineering, State University of Malang. Based on data on the PDDikti official website, the number of students in the Department of Electrical Engineering, State University of Malang in six study programs in 2018/2019 reporting is 2,294. Of these, simple random sampling technique was used. The number of samples used as a trial was obtained by the Solving Sample Formula (1), where n is number of samples, N is number of population, and e is error rate**.** The number of samples of students who became the subject of the trial was rounded up to 96 students.

$$n = \frac{N}{1+Ne^2} \quad (1)$$

The types of data presented in this research and development are in the form of quantitative data and qualitative data. Quantitative data was obtained based on the results of filling out the instrument at the testing stage carried out by information systems experts and testing on users in the field. Meanwhile, qualitative data were obtained from responses and suggestions for development both verbally and non-verbally when tested by information systems experts and tests carried out in the field.

That there are five main components used in measuring the usability of a software, namely ease of use (learnability), resource efficiency (efficiency), easy to remember (memorability), errors and software security (errors and security) and satisfaction from users (satisfaction) [6].

Data analysis techniques are used to determine the feasibility of the developed product and its implementation. The data processing technique in this research and development uses a quantitative descriptive approach. The data processing of

the system test results is carried out using equation (2), where P is validity percentage, ∑x is right answer score, and ∑xi is maximum score**.** The information system development carried out can be said to be valid if the results obtained from the test have reached a minimum percentage of 70.01% [7].

$$P = \frac{\sum X}{\sum Xi} \quad (2)$$

III. Results and Discussions

A. Product Development Results

The resulting product is a website-based thesis and final project information system. The interface design on this website is made using the Bootstrap version 4 framework from SB Admin 2. The placement of the simple additive weighting algorithm is in the title review feature section.

Recommendations for supervisors are obtained based on the three criteria mentioned in the introduction, namely: (1) the rank and class of lecturers obtained based on the rank, position, and class of lecturers; (2) the suitability of the title with the lecturer's field of expertise, this suitability is obtained by comparing the new title proposed by the student with the thesis title that has been guided by each lecturer; (3) the number of students under the guidance of lecturers is obtained from the number of students under the guidance of each lecturer in the information system [8], [9].

The results of the recommendations of the thesis supervisor or final project are displayed in the form of a dropdown or options that can be selected by the user who is reviewing the title. The dropdown view of the supervisor's recommendation is shown in Fig. 2. The final determination of the supervising lecturer is still carried out by the user, namely the study program coordinator.

B. Product Validation Results

Information system testing is carried out by information systems experts and all levels of user access in the thesis and final project information system. The test was conducted using an online questionnaire through the Google Form service.

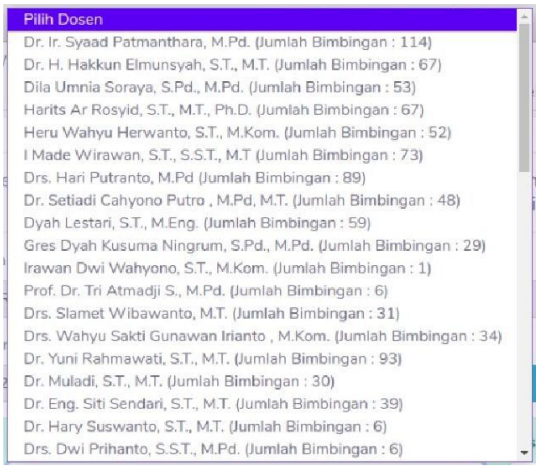

Fig. 2. The supervisor's recommendation results by the system

Testing by system experts is used to test and determine the performance and functionality of all the features in the thesis and final project (SISINTA) information system. The collected data are grouped based on aspects of learnability, efficiency, memorability, and security and error. The results of the validation by information systems experts are shown in Table 1.

Testing of thesis and final project information systems on student access rights is carried out to measure system performance in terms of functionality and usability at the student access level. The test was carried out by 108 respondents from students in the Department of Electrical Engineering, State University of Malang. The collected data are grouped based on aspects of learnability, efficiency, memorability, and security and error. The results of validation by students are shown in Table 2.

Testing the thesis and final project information system on the access rights of the supervisor is carried out to measure the performance of the system in terms of functionality and usability at the lecturer access level. The test was carried out by three respondents who are lecturers at the Department of Electrical Engineering, State University of Malang. The collected data are grouped based on aspects of learnability, efficiency, memorability, and security and error. The results of the validation by the supervisor are shown in Table 3.

Testing the thesis and final project information system on the access rights of KBK members is carried out to measure system performance in terms of functionality and usability at the access level of KBK members. The test was carried out by two respondents who are lecturers as well as members of one of the KBK in the Department of Electrical Engineering, State University of Malang. The collected data are grouped based on aspects of learnability, efficiency, memorability, and security and error. The results of the validation by KBK members are shown in Table 4.

Testing the thesis and final project information system on the access rights of the KBK chairperson is carried out to measure the system's performance in terms of functionality and usability at the access level of the KBK chairperson. The test was carried out by one of the lecturers who is the chairman of one of the KBK in the Department of Electrical Engineering, State University of Malang. The collected data are grouped based on aspects of learnability, efficiency, memorability, and security and error. The results of the validation by the head of the KBK are shown in Table 5.

Testing of the thesis and final project information system on the study program coordinator's access rights is carried out to measure the system's performance in terms of functionality and usability at the coordinating study program's access level. The test was carried out by one of the lecturers who is a coordinator of one of the study programs in the Department of Electrical Engineering, State University of Malang. The data obtained from this test consists of quantitative and qualitative data. The collected data are grouped based on aspects of learnability, efficiency, memorability, and security and error. The results of the validation trials by the study program coordinator are shown in Table 6.

C. Discussion of System Testing Results

Based on the results of testing the functionality of the information system by system experts and users, the percentage of system validity obtained is 100% from information systems experts, 97.41% from students, 93.75% from supervisors, 100% from KBK members, KBK chairman, and coordinator study program. From all the results obtained, an average of 98.24% is obtained for the results of all levels of user access to thesis and final project information systems, with these results the software developed can be declared very valid and can be used without the need for revision.

The test process on students has several features that are still not running according to user expectations, namely the changing guidance log feature and the ticket support feature. The possible cause for this to happen is that the user has not tried these two features because they are still classified as new features that have just been embedded in SISINTA. The guidance log change feature was embedded on the website on April 19, 2020 and the ticket support feature was embedded on April 26, 2020, while the process of collecting trial data by students began on May 2, 2020.

Research with the title "Recommendations for Mapping Student Expertise against Job Vacancies Specifications in the Special Job Exchange System Using the SAW Method in Vocational High Schools" was declared valid with a percentage result of 97.47% [10]. Based on the results of the percentage of these studies, the results obtained in research and development of DSS determination of The supervisor with the SAW algorithm is declared valid.

IV. Conclusion

The result or product resulting from the development carried out is a thesis and final project information system (SISINTA) by implementing the Simple Additive Weighting (SAW) method in the assessment section of the thesis title or final project. This information system can be used or accessed using a variety of devices that have a connection or are connected to the internet. This information system basically provides services to users to carry out the thesis or final project process starting from the submission of titles to the trial. Some of the access rights contained in this information system are: (1) students; (2) study program coordinator; (3) the chairman of the KBK; (4) KBK members; and (5) supervising lecturer. Each access right to the information system has different features that are distinguished based on the user's access rights. The SAW algorithm is placed on the access rights of the KBK chairman, KBK members and study program coordinators to provide appropriate supervisor recommendations for titles submitted by students in this information system.The developed product has also gone through the feasibility test of this information system carried out by information system experts and users on each access right. The results obtained in this test obtained a validity percentage of 100% from information systems experts and 98.24% from all levels of user access, so that this information system was declared feasible to be used in the Department of Electrical Engineering, State University of Malang.

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