APPLICATION OF THE SIMPLE ADDITIVE WEIGHTING METHOD TO DESIGN AN INTEGRATED EMPLOYEE ASSESSMENT SYSTEM IN NATIONAL NON-PROFIT ORGANIZATION

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ABSTRACT

The goal of this project is to develop a web-based decision support system that will help in hiring the most qualified personnel. Three primary methods were used in this study to collect data: literature review, interviews, and observation. This study uses the waterfall method for developing decision support systems. A decision support system has been created utilizing the simple additive weighting method to choose the best employees based on the research findings. Employee name and position are required pieces of information. This method yields results in the form of a cumulative score from candidates who should be recognized as the best employees and given an award. The decision-making process takes into account the rating of prospective award recipients, which is displayed via this decision support system. Determining preference values, criteria, and weights for each criterion is the first step in ranking the best personnel. Next, alternative input and ranking are carried out, followed by calculating the total value for each alternative. The system will display the total value of all ranked alternatives, and only the top 5 alternatives will appear on the main page. The aim of this research was achieved after non-functional testing on users, where it was found that users felt that this system could reduce subjectivity in decision-making. The decision-making process also becomes more transparent because the assessment results of all alternatives are displayed, making it easier for managers to make decisions regarding awarding the best employee title.

Keywords: Foundation, Simple Additive Weighting, Decision Support Systems, Subjective

INTRODUCTION

A company's development is inextricably linked to the caliber of its human resources, particularly the role that employees play. They not only carry out routine tasks but also become the main pillars in achieving company goals. Therefore, effective and directed human resource management is very crucial [1]. Good management of human resources will ensure that employees are managed well, supported to develop, and provided with motivation and a conducive work environment. This helps in creating a positive work culture, increasing productivity, and strengthening employee engagement with the company. By focusing on development, training, rewards, and open communication, a company can ensure that its human resources become valuable and strategic assets in facing challenges and achieving long-term success [2].

Employees with the finest performance receive prizes from the organization each year in human resource management. This award's goal is to boost staff members' motivation to work harder and achieve better. Nonetheless, a manual or human-based method is still used to identify the top workers. In this process, the COO (Chief Operational Officer) is responsible for recommending candidates who are worthy of receiving awards to central management [2]. Unfortunately, this frequently leads to decisions that are not transparent because they lack clear data evidence as to why the candidate is deserving of being the best employee. Thus, companies need to consider adopting a more objective and measurable assessment process, such as using a data-based decision support system, to ensure that awards are given to employees who truly have superior performance and contribute significantly to the company's success [3].

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One method to reduce subjectivity and increase transparency in the process of selecting the best personnel is to develop a decision support system that selects candidates based on predefined standards. In this instance, a decision support system serves as a tool to assist decision-makers in completing the data processing that is pertinent and required to make decisions on an issue more rapidly and precisely, rather than as a tool for making decisions itself [4]. The suggested system should also prioritize using intuitive judgment when making decisions and be able to assess all factors that affect the choice of project managers [5].

The Simple Additive Weighting (SAW) approach will be applied in this study to do calculations related to choosing the top personnel. This approach was chosen because it can choose the best option from a range of options by applying predetermined criteria. The user has the ability to modify the weight values based on their preferences, and the criteria are dynamic [6]. After that, a ranking procedure is used to identify the top workers. The SAW method's benefit is that it can ascertain the weight value for every attribute and then move forward with the ranking process to choose the best option out of several options. Aside from that, the SAW model's benefit over other decision-making models is its capacity for more accurate evaluations due to its usage of predefined preference weights and criterion values [7].

1. LITERATURE REVIEW

Interactive information systems that offer data manipulation, modeling, and information are called decision support systems. When there is uncertainty about the best way to make decisions in semi-structured or unstructured situations, this system is utilized to help. All phases of the decision-making process, including problem identification, pertinent data selection, choice of strategy, and assessment of alternative selection activities, are supported by decision support systems [8] [9].

The process of selecting the best option from a range of options that meet predetermined criteria is known as multiple attribute decision making, or MADM. The main goal of MADM is to weigh each attribute and then go on to the ranking process, which will choose from among the available options [10]. MADM frequently employs the SAW technique to identify a substitute. The challenge that frequently arises is determining which approach, when applied to a situation using the MADM model, is more pertinent. The most straightforward and popular MADM technique is the SAW method [11].

Because of its simple algorithm, this approach is also the most straightforward to utilize. The addition technique, which yields weights, is another name for the SAW method. The SAW method's fundamental idea is to calculate the sum and then give each alternative's performance rating across all criteria a weight [12].

Information systems are a crucial tool for adding value to businesses. Through the provision of information that assists managers in making better decisions and enhances the efficiency of business processes, information systems allow a corporation to either boost revenue or decrease expenses. Within an organization, management encompasses several tasks such as organizing, planning, supervising, directing, and so on [13]. On the other hand, data that has been processed so that it has significance and value for the organization is what constitutes information in an organization. Based on this, it can be said that a management information system (SIM) is a system that collects, processes, and arranges data and information that is helpful in assisting an organization in carrying out its activities [14].

A systematic and sequential approach to software development is described by the waterfall method, also known as the classic life cycle [15]. It begins with the specification of user requirements and moves through the phases of planning, modeling, construction, and system delivery to clients and users before concluding with support for the entire software produced [16].

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2. METHOD

2.1. Data Collection

In this research, data collection methods were carried out through three main approaches: observation, interviews, and literature study. Observation is a method used to obtain data by directly observing the research object. Observation activities are carried out by making direct observations at the service institution that is the focus of the research. With this approach, researchers can collect data directly from observed situations or conditions, providing in-depth insight into various aspects related to the research topic.

An interview is conducted by asking questions directly to a source to obtain data. In this research, interviews were conducted with Human Resource Department to find out what problems and criteria are important in determining the best employees. As well as interviews with the COO (Chief Operational Officer) of the company to obtain information regarding the process for selecting the best employees that has been implemented, as well as requests for permission to collect employee data.

A literature study is a technique for gathering data that involves looking for, reading, and gathering references from a variety of sources, including books, papers, and research-related final assignment literature. To find out more about decision support systems, the simple additive weighting method, hiring the best personnel, and other topics, a literature review is conducted.

2.2. System Development Methods

This study uses the waterfall method for developing decision support systems. The waterfall approach of development involves multiple consecutive phases, including requirements, system design, implementation, testing, and maintenance. The following are the specifics of each step in the waterfall method:

1. Requirements Analysis

Communication is necessary at this stage of system development in order to comprehend what users expect from the software and its constraints. Typically, questionnaires, conversations, or interviews can be used to get this data. After that, the data will be examined to ensure the user has the information they require.

2. System Design

The requirements specification from the previous step is completed at this point. This phase will involve a study and the preparation of a system design. System design aids in designing the overall system architecture as well as the hardware and system requirements.

3. Implementation

During this phase, the system is initially created in compact programs known as units, which are then combined in later phases. Unit testing is the process of developing and evaluating each unit for functionality.

4. Integration and Testing

Following each unit's testing, all units created during the implementation phase are incorporated into the system. The system is tested as a whole after integration to look for any flaws or faults.

5. Operation and Maintenance

The waterfall model is the last phase. The program is completed, operational, and up to date. One aspect of maintenance is fixing mistakes that were missed in the earlier stages. The new prerequisites include enhanced system services and better system unit implementation.

Table 1: Comparison of System Development Methods

Method Name	Explanation	Excess	Lack
Waterfall Models	A gradual system development method	Easy to apply. Provides templates on	It is rigid, so it is difficult to change the software system.

	from one phase to the next	how to analyze, design, code, test, and maintain.	
Prototyping Models	System development method by making a prototype	Saves development time The developer can determine the customer's needs so that he can work well.	Sometimes users fail to see or understand that the current software does not yet have the full functionality of the program.
RAD Models	A system development method does not need to be gradual; the important thing is that it matches the wishes of the user.	Ideal for tasks requiring a brief turnaround time	High-risk technological systems are not a good fit for RAD.

A system will be designed to correct the shortcomings of the current manual assessment system. The steps in the design consist of: Process design in the application using functional modeling. Designing the structure and display of application program menus.

At the system evaluation stage, adjustments are made with prospective users regarding the system they want to create. An evaluation is carried out to see whether the design created is in accordance with the user's wishes. The evaluation results are then used to modify or improve the system design. Then, to ensure that the system succeeds in producing data as expected, accuracy testing is carried out. Using a MySQL database and the HTML, CSS, and PHP programming languages, a decision support system was implemented and built to identify the best personnel.

3. RESULT AND ANALYSIS

To get the best employee award from a company, of course, the selected employees must meet the specified criteria. In making a system, criteria and interval values are needed as material for making decisions. Before creating a decision support system, an analysis of the problems found in the previous best employee selection system was first carried out.

After that, the SAW method where criteria are required and the system you wish to design are explained. In the end, employee data and data to determine what attributes make an employee deserving of being the best are required to build a decision support system utilizing the SAW technique. Interviews, observation, and email were used to gather data.

The criteria used to determine the best employees have been obtained through interviews conducted. There are five main criteria that are taken into consideration in the assessment: discipline, cooperation, responsibility, communication, and order. By using these criteria, companies can carry out a comprehensive assessment of employee performance and contribution to achieving company goals.

The first criteria used in determining the best employees are in terms of discipline, where the value of discipline is assessed by the employee's attitude towards others. The grammar used and politeness towards other workers will greatly influence the assessment of this criterion. The higher the discipline value, the higher the employee's chances of becoming the best employee.

The second criterion is in terms of cooperation. This collaboration value is assessed based on the employee's ability to work together with other employees in the department he is placed in. The ability to exchange ideas and then the availability to accept other people's opinions and focus on important goals are things that are considered in this criterion.

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The next criterion is responsibility. Responsibility criteria are assessed based on the employee's ability to carry out the work entrusted to him. Responsibility criteria evaluate one aspect, which is the ability to complete tasks on time and in accordance with existing agreements.

The next criterion is communication. The value of this communication is assessed based on the employee's activeness in expressing their opinions. Employees' activeness in exchanging opinions with colleagues and their willingness to express their thoughts will be very influential in assessing this criterion.

The final criterion is order. These order criteria are assessed based on employee behavior toward various existing rules and regulations. The level of absenteeism and dress code are some of the things that are considered for this criterion. Based on the specified criteria, everything is included in the benefits because the highest score is the best of all the specified criteria.

Currently, a weight with a total of 100 is the one that best suits the company's needs. So that a weight is given to each criterion, reaching a total of 100. The assessment data will then be submitted to the HR department to be entered into the application. The decision support system will then process the assessment data to produce a final score report for each employee. The report will then be given to the manager, who will check the results of the ranking report, and the report will be used as a reference by the manager to determine the best employee. The ranking data from the system only functions to help support the manager's decisions, but the final decision remains in the hands of the manager.

The design of the interface and arrangement of functions in this application are based on the needs of users, especially human resources administrators, to access and use the website easily. The login interface is designed simply with input in the form of a username and password, following the principles of the eight golden rules in creating the interface. Interface consistency is maintained by using the same font and setting the navbar at the top for access to other pages in the application. An error warning is displayed when the user inputs duplicate data.

The application's main page displays various information that is important to users, including data on preference values, criteria, and the top five alternatives. This data is taken directly from the PhpMyAdmin database, which is filled based on input and calculation processes carried out by the system. Users can easily see the ranking of the top 5 alternatives in the form of a clearly presented bar chart graph. Thus, this main page provides a brief but informative overview of employee performance and status, as well as aspects that are taken into consideration in decision-making.

When users access the "values" page from the navbar, they can view and manage existing value preferences, including adding, changing, and deleting data. Users can add preference data by clicking the add data button, filling out the form, and saving new data. To change preference data, users simply click the edit button in the action column, then change the required data.

The "criteria" page gives users access to view and manage existing criteria, with options to add, change, and delete criteria. The process of adding and changing criteria is carried out by filling out the form provided and saving changes as needed.

If users want to add criteria data, they can simply click the "add data" button. Next, the user will be redirected to the add criteria page. Here, users are required to fill in a form with the "criterion name" information, select the "criteria type" (whether cost or benefit), and fill in the "criteria weight" as needed before saving the data by clicking the "save" button.

Meanwhile, if users want to change the criteria data, they can simply click the edit button available in the action column on the same page. Users will be redirected to the change criteria page, where they can change the data by filling in the "criteria name" form, selecting "criteria type," and filling in the "criteria weight" before saving the changes by clicking the "change" button.

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When users click "alternatives" on the navbar at the top of the application, they will be redirected to a page where they can view and manage existing alternative data. Users have the option to add, change, and delete alternatives. The process of adding alternative data is carried out by clicking the "add data" button and filling in the "alternative" and "position" forms before saving the data by clicking the "save" button.

To change alternative data, users simply click the edit button in the action column on the same page. Users will be redirected to the change alternative page, where they can change the "alternate name" and "position" information before saving the changes by clicking the "change" button.

When users click "ranking" in the navbar at the top of the application, they will be taken to a page where they can view and manage existing ranking data. Users have the option to add, change, and delete existing rankings.

If users want to add ranking data, they can simply click the "add data" button. Next, the user will be redirected to the add-ranking page. Here, the user must select "alternative" with the "criteria" available in the application, then fill in the desired ranking values before saving the data by clicking the "save" button. It is important to note that users cannot add data for alternatives with criteria that have already been assigned a value.

Meanwhile, if users want to change the ranking data, they can simply click the edit button available in the action column. Users will be redirected to the change ranking page, where they can change existing values before saving changes by clicking the "change" button.

The application will automatically process the normalization r rating for each alternative with the existing criteria when the user puts in the values for each alternative using the criteria that are already in place. Clicking "rank" will take users to the ranking page where they may view the normalization results of a particular ranking.

Users can get an exhaustive report of all the data recorded in the program on this page. Users have access to three tables. The r normalization table comes after the alternative criteria value table, which initially contains alternative names and value data that the user provided for each alternative with existing criteria. Lastly, there is the final results table, which displays the outcomes of the computation process employing the straightforward additive weighting approach.

The blackbox method is used to test decision support systems used to identify top personnel. All of the application's features and functions are used during testing to make sure the outcomes live up to expectations. Users can test the system from any convenient place by using a web browser to access the program. Based on the results of black box testing, it can be concluded that the system is free from syntax errors and can produce results that are as expected. Based on the findings of non-functional testing, it is possible to draw the conclusion that the system is well-liked by users and also aids in lowering subjectivity in decision-making.

Non-functional testing is performed to evaluate system acceptability and subjectivity related to the application background. For this reason, a questionnaire was prepared and given to the employees involved to evaluate their subjectivity. The human resources administrator is responsible for filling out this questionnaire.

A username and password are given to the human resources administrator to access the system and provide assessments. The questionnaire is filled out by the hr administrator, and the data is then processed to obtain assessment results. An overview of users' subjective reactions and acceptance of the decision assistance system is given by the non-functional testing results. The evaluation's findings serve as the foundation for system enhancements that better meet user requirements and expectations.

Table 2: Non-Functional Test Results

Statement	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)
1	0%	0%	0%	12.5%	0%

2	0%	0%	0%	12.5%	0%
3	0%	0%	0%	0%	1.5%
4	0%	0%	0%	12.5%	0%
5	0%	0%	0%	12.5%	0%
6	0%	0%	0%	12.5%	0%
7	0%	0%	0%	12.5%	0%
8	0%	0%	0%	0%	12.5%
Total	0%	0%	0%	75%	25%

4. CONCLUSION

The simple additive weighting method has been used in the creation of a decision support system for the purpose of choosing the best personnel. Names and roles of the employees, which serve as study samples, are required data. This method yields results in the form of a cumulative score from candidates who should be recognized as the best employees and given an award.

The decision-making process takes into account the rating of prospective award recipients, which is displayed via this decision support system. Determining preference values, criteria, and weights for each criterion is the first step in ranking the best personnel. Next, alternative input and ranking are carried out, followed by calculating the total value for each alternative. The system will display the total value of all ranked alternatives, and only the top 5 alternatives will appear on the main page.

The aim of this research was achieved after non-functional testing on users, where it was found that users felt that this system could reduce subjectivity in decision-making. The decision-making process also becomes more transparent because the assessment results of all alternatives are displayed, making it easier for managers to make decisions regarding awarding the best employee title. So that the system can be implemented better, it is necessary to add features to the system to be able to input rankings of alternatives directly against all existing criteria, because the current system still has to input rankings for alternatives against the existing criteria one by one.

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