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Personnel Information System and Applied AHP Method For Selecting The Best Employee at Gadingsari Village

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ABSTRACT

Currently, we are in the era of the industrial revolution 4.0 where the role of technology is very rapid. This affects the many demands and intense competition for the digitization of the work system. Personnel is one part of the government organizational structure that requires information system in order to be able manage Human Resource (HR) and the other personnel. Its purpose is to regulate the empowerment of employees according to organizational goals. This research is about the Personnel Information System (PIS) which will be designed in order to help Gadingsari Village to manage the administrative section of employees. The design method used is the waterfall method, and the Analytical Hierarchy Process (AHP) method for making decisions to determine the best employees. The results of the design consist of several menus, namely Employee Data, Attendance, Employee Recommendations, Edit Profile, Employee Data Report, Attendance Report, and Managing Admin. The calculation uses the AHP method with the criteria of Responsibility, Work Experience, and Attendance. This calculation can be used for selecting the best employees with acceptable index consistency.

INTRODUCTION

In the industrial revolution 4.0 where technology and information systems are needed to assist an company to make it easier to manage data so that the activities of a company can run more productively, easily, accurately, and safely. The development of information technology is currently quite rapid, covering various human activities, for example activities in organizations. The application of technology in an organizational activity is one of the unique discourses because currently almost every organizational activity uses technology on the grounds that it can increase efficiency and effectiveness as well as a competitive advantage significantly [1]. One of the developments that became an important point was the need for a tool to process data that had a function as a tool to produce the required data [2]. Therefore we need to keep up with the times by using data processing tools, namely computers. With the computer we can provide information accurately, and quickly [3][4]. Personnel contains information about the workforce and departmental structure [5]. This personnel is also an art for planning, organizing, and supervising the workforce, in this series it can make the process more efficient and effective in achieving the goals of an organization or company [6][7]. There are several problems faced by the village government of Gadingsari which have been agreed in the Musrenbangdes which presents representatives from competent hamlets, one of which is the problem in managing these employees

[8]. The SIP made aims to assist the Gadingsari village government in managing employees. In addition, this SIP will add a decision-making feature using the AHP method, which can be used to select personnel, and recommend employees for candidates for promotion.

METHOD AND MATERIALS

There are 2 methods that will be used for the applied on this Personnel Information System (SIP), that is Waterfall Method and Analytical Hierarchy Process (AHP) method.

1. Waterfall Methods
   In the waterfall design method, this is one method that is often used in the development stage. The waterfall method has several main stages that reflect the basic development. The 5 stages are requirements analysis and definition, system and software design, implementation and unit testing, integration and system testing, and the last one is operation and maintenance [9]. For an overview of this waterfall method, it can be seen in **Figure 1**.

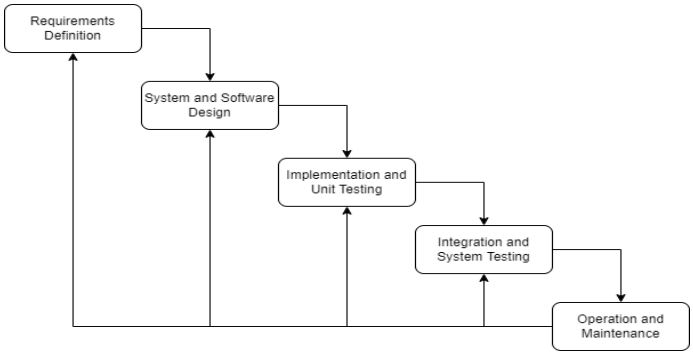

FIGURE 1. *Waterfall Method*

- Requirement Analysis and Definition
  This step for implementing the features, constraints and objectives of the system through consultation with the user.
- System and Software Design
  This step is a step that will form a system based on pre-determined provisions.
- Implementation and Unit Testing
  This step is the result of the design of a software that will be realized as a program unit and each program unit will carry out testing to try whether the program has met its needs or not.
- Integration and System Testing
  At this step, each program unit will be integrated and tested as a single system to ensure that the system meets the requirements that have been created previously.
- Operation and Maintenance
  At this step, the system will be installed and put into use. If there is an error program that is not found at the manufacturing stage, maintenance of the program will be carried out. And at this stage, system development will be carried out such as adding new features.

1. Analytical Hierarchy Process Method
   The AHP model is a method for ranking decision alternatives and choosing the best using several criteria. The AHP assigns a numerical value to rank each other method of decision, according to the extent to which each other method satisfies the decision maker's criteria [10], [11], [12]. This method is the most often used for the use of decision-making systems. The steps using this AHP method are:
   - Defining the problem and identifying the desired solution, then compiling a hierarchy of problems being faced.
   - Determine criteria and alternatives (sub-criteria).
   - Determine the value of pairwise comparisons, and determine one criterion of importance compared to others.
   - Determine the normalization matrix.
   - Calculating the Consistency Index (CI) using the formula, Eq. (1):

$$CI = \frac{\lambda aks -}{-1}$$

(1) Calculate the Consistency Ratio (CR) using the formula, Eq. (2).:

$$CR = \frac{CI}{\overline{C}R} \quad (2)$$

And the last is to determine the ranking of alternatives by calculating the eigen vectors for each criterion and alternative (sub-criteria).

The data collection technique is to make observations on the design object, namely the personnel application and direct interviews with the village government employees and take the data needed in designing the system that the research is working on.

RESULT

The results of this study are the application of personnel information systems and the application of decision making that will be used to get the best employees as recommendations for promotions. The following are use case diagrams **(Figure 2)**, and class diagrams **(Figure 3)**, that have been made in the design of this PIS application.

FIGURE 2. *Usecase Diagram PIS*

After making the PIS design, it will be continued with the calculation of the AHP method. But, before starting the calculation of the AHP method, it is necessary to determine the hierarchical structure in order to assist in solving problems that can be described as elements of criteria and alternatives. The following is the hierarchical structure shown in **Figure 4**.

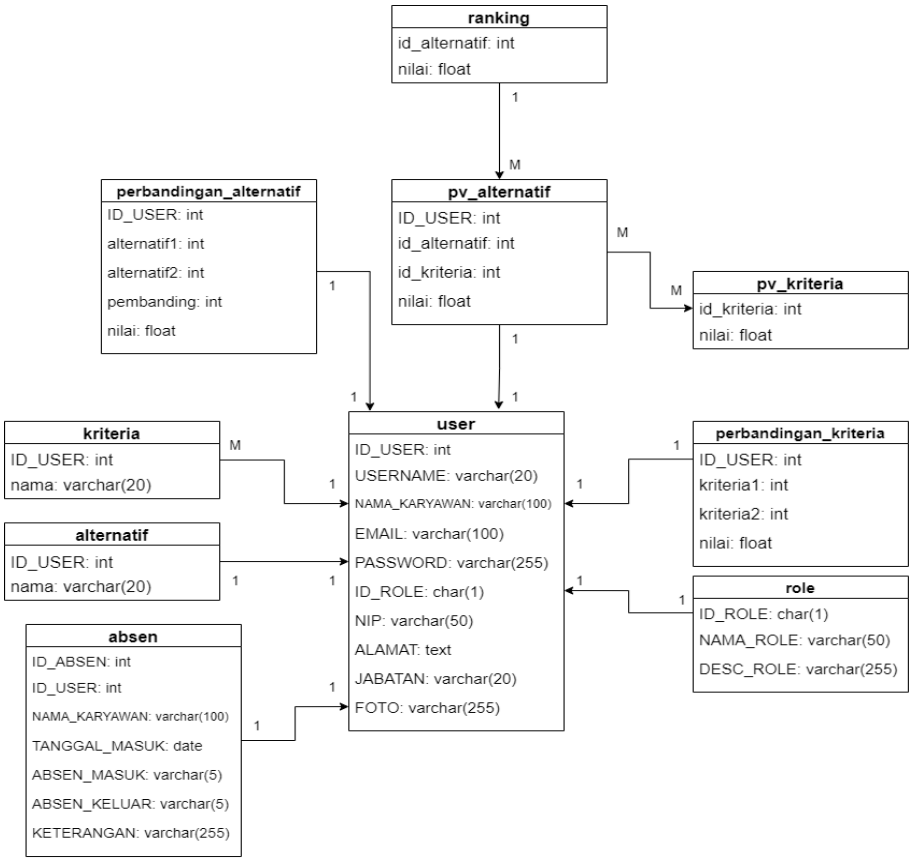

FIGURE 3. *Class Diagram PIS*

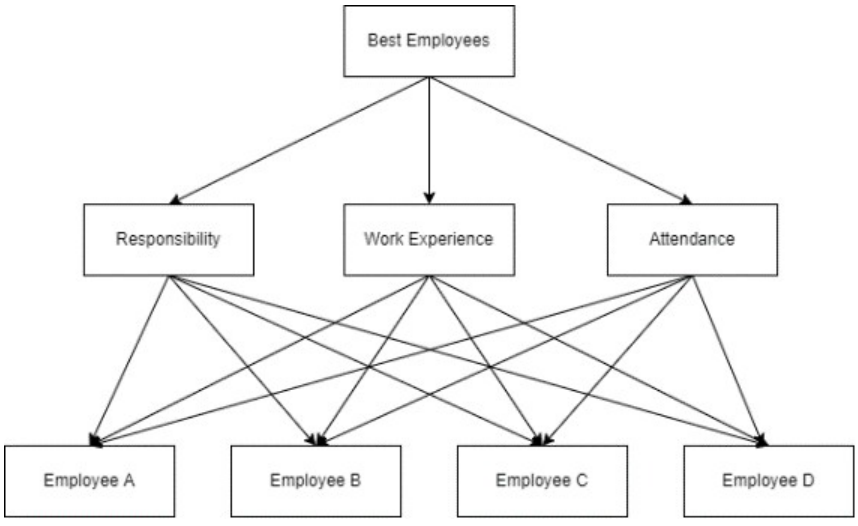

FIGURE 4. *Hierarchy Structure*

After finishing making the hierarchical structure, proceed with determining the criteria (C_1, C_2, C_3, … , C_n) in Table 1.

Table 1. Decision-making Table

C	Criteria
C1	Work Experience
C2	Responsibility

Then the next step is to determine the weight of the criteria, which can be seen as follows.

- Responsibilities are 3x more important than Work Experience.
- Attendance is 2x more important than Work Experience.
- Responsibility is 2x more important than Attendance.

After determining the criteria, alternatives and the weight of the criteria, proceed to the next step, which is to create a pairwise comparison matrix for the criteria, which can be seen in **Table 2**.

Table 2. Criteria Paired Comparison Matrix

Work Experience		ility	nce
Work	1	3	2
Experience	0,33	1	2
Responsibility	0,5		1

After getting the pairwise comparison matrix, the next step is to find the Eigen Vector and add up the results. The following is the calculation of the Eigen values in **Table 3**.

Table 3. Vector Eigen Values and Addition Results

Eigen Vector			Total
2,9	7	10	19,99
9	4,66	9,31	9,31
1,6	2,5	3	6,665

After getting the number of each row, the next step is to calculate the weight of each criterion by dividing the number of rows by the total number of each criterion, which can be seen as follows:

1. Work Experience Criteria = 19,99 / 35,9 = 0,55
2. Responsibility Criteria = 9.31 / 35.9 = 0.25
3. Attendance Criteria = 6.665 / 35.9 = 0,18

The next step is to find the value of the consistency ratio (CR) where this calculation serves to determine whether the value of CR ≤ 0,1. If the value of CR ≥ 0,1 then the value of the comparison matrix must be searched again. Here's the calculation:

- Maximum Eigen Value: $\lambda maks$ = (1,83*0,55)+(4,5*0,25)+(5*0,18) = 3,108

a) Calculating the Consistency Value: CI = $\lambda maks$ – n / n-1 = 3,108 – 3 / 3-1 = 0,05
b) Calculating consistency ratio: CR = CI / IR = 0,054/0,58 = 0,093

Because the CR is ≤ 0,1 then the value is consistent. After we got the CR for the criteria, Then proceed with filling in and calculating alternative comparisons on each criterion, which uses the same formula as when calculating the criteria above. After determining the value of the alternatives

for each criterion, it is continued by calculating λmaks, CI, and CR for each alternative criteria:

2. Comparison of Alternatives on Work Experience Criteria
    a) Maximum Eigen Value: λmaks = 4,256
    b) Calculating the Consistency Value: CI = = λmaks – n / n-1 = (4,256 – 4) / 3 = 0,085
    c) Calculating consistency ratio: CR = CI / IR = 0,085 / 0,90 = 0,096
3. Comparison of Alternatives on Responsibility Criteria
    a) Maximum Eigen Value: λmaks = 4,160
    b) Calculating the Consistency Value: CI = λmaks – n / n-1 = (4,160 – 4) / 3 = 0,053
    c) Calculating consistency ratio: CR = CI / IR = 0,053 / 0,90 = 0,058
4. Comparison of Alternatives on Attendance Criteria
    a) Maximum Eigen Value: λmaks = 4,080
    b) Calculating the Consistency Value: CI = λmaks – n / n-1 = (4,080 – 4) / 3 = 0,026
    c) Calculating consistency ratio: CR = CI / IR = 0,026 / 0,90 = 0,028

Based on the calculation for the alternatives on each criterion, the value is less than 0.1, which means that the value is consistent. Then the next step is to display the alternative ranking results in **Table 4**.

Table 4. Ranking Results of Alternatives

Alternative	Value	Ranking
Employe	0.436412	1
e A	0.367169	2
Employe	0.122115	3
e B	0.0743035	4
Employe		

Based on the ranking results in the table above, Employee A got as the best employee who can be used as a candidate for promotion to the Gadingsari Village Government.

CONCLUSION

The results of this study are in the form of a Personnel Information System with decision making to determine the best employees. This Personnel Information System has several features that have been created, namely employee data menu, edit profile, attendance, employee recommendations, employee data reports, attendance reports, and managing admin. After that, for this decision-making system, if you look at the previous calculations, the consistency ratio value is less than 0.1, which means that the value is consistent and the application can be used properly.

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