

Knowledge management system SOP using semantic networks connected with personnel information system: case study Universitas Singaperbangsa Karawang

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Abstract

Document Standard Operating Procedures (SOP) can manage business processes and employee performance in an organization. This study aims to develop a system that can publish SOP documents automatically distributed to employees. In this study, an analysis of the relationship between SOP documents and employees is carried out so that it can be directly allocated to employees according to the position. Knowledge analysis of the relationship between SOP documents and employees is done using semantic network analysis. Semantic networks are used to analyze components of knowledge and the relationship between SOP documents and employees. The results of the report of the elements of knowledge and the relationship between SOP documents found 25 SOP documents were consisting of 6 types of central nodes with 156 child nodes and had 7 types of relations containing 207 relations. SOP knowledge management system is connected to the personnel information system (SIPEG) so that it makes it easier for users to find, accommodate, and manage the knowledge contained in SOP documents. System implementation is done using PHP programming language with CodeIgniter framework, Rest API, and MySQL database.

Keywords: CodeIgniter, extreme programming, semantic network, standard operating procedures

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1. Introduction

Standard Operating Procedure (SOP) can regard as an essential component in ensuring the consistency of data quality as well as information. SOP provide complete information to the staff involved in doing their job well and in a standardized manner according to the terms agreed. SOP can ensure a behavior of the user of the system was running by the referenced standards. Also, SOP can support the work process for the better because a policy or procedure is a significant factor that promotes success in an organization [1-3].

University Of Singaperbangsa Karawang (UNSIKA) is a university located in Karawang city and has been establishing since 5 September 1965 [4]. UNSIKA is one of the institutions that implement SOP in the implementation of performance in it. But the lack of knowledge of the document management system that focuses on SOP documents in UNSIKA create some problems that often arise. Among the difficulties in managing SOP documents experienced by the administration. Then the difficulty in finding SOP documents that want to target because of the absence of an SOP document repository system. Also, some employees sometimes take a long time finding SOP documents needed for personnel interests. Knowledge of SOP is required so that all employees involved in it perform the performance by the applicable SOP. The semantic network is a representation of an object depicted in the form of a circle or node and rectangle or arc which is a linking groove represented in the shape of arrows [5]. Semantic networks are widely used to describe a connectedness of some objects. Therefore, what makes many researchers use semantic networks in facilitating the search process. Research in the development of the knowledge management system using a semantic web has been done a lot before. For example in the study [6]. The research applied a semantic network as a graphical representation of text mining to documents in the Biomedical field.

Furthermore, in the study [7] which presents a method for knowledge representation agents with nodes and activation level links defined in examples, concepts, relations, and axioms. In addition to other studies by Aritonang et al. [8] semantic networks are used in the form of an ontology that presents the hierarchical relationship of the many regulations imposed by the customs director general. The purpose of the study is to make it easier for users to search, manage and track the history of change and the relationship between rules used by the organization [8]. Hasan et al. [9] apply semantic network to present an approach of web services composition based on both semantic description and QoS; such research is focused on the hierarchy of web services.

Research on knowledge management of SOP document has been done by Pangudi that is by making knowledge management system of SOP based ontology document. The analysis uses the semantic network with application of Knowledge Management System (KMS) method which is named SOP Navigator. SOP Navigator is a web-based application that serves as a search system, navigates SOP documents and manages SOP document data. SOP Navigator made with the implementation of semantic network based ontology using database graph.

But the prototype of the SOP Navigator system that has been developing is still an early development. Search patterns implemented on this system only use searches with names from nodes not advance query. Also, SOP Navigator system has not been integrating with other information systems are interrelated. The absence of integration with other information systems according to the scope of previous research makes the SOP document only known if the user opens the SOP Navigator application [10].

Base on these studies, to make knowledge management document SOP UNSIKA can facilitate users especially employees involved in it, in accessing information related to SOP documents. For SOP knowledge management system to have more appropriate and can be monitored to the performance of employees according to applicable SOP, the method of knowledge management and management of SOP documents integrated with SIPEG UNSIKA. SIPEG UNSIKA is one of information system applied in UNSIKA as an information system that supports administrative process and personnel resources in UNSIKA.

2. Research Method

Stages of research that will be done based on the problems caused are how to create a centralized document management system SOP and integrated with SIPEG UNSIKA. Stages of research that was done are by using software engineering methods, or System Development Life Cycle (SDLC) model approach extreme programming (the steps include: (1) Planning and Analysis, (2) Design, (3) Implementation, (4) Testing).

2.1. Planning and Analysis

This stage is done by analysis based on user needs and software requirements, as follows:

1) User Requirement

At this stage the user's investigation is done in the management of SOP documents with two techniques, namely:

- a) Interview
- b) Observation

2) Software Requirement

At this stage will be analyzed the needs required by the software or functional needs. The purpose of this software needs analysis to facilitate the design of system development to make. The begin by studying the ongoing process flow, making the link to SOP document in UNSIKA in semantic network form, what are the main features needed, then how to make SIPEG UNSIKA document management information system.

In representing a semantic network, the model requires more in-depth analysis first. According to Atteveldt in semantic network analysis, there is a relationship between concepts in a semantic network [5]. Such ideas can be actors, issues, or abstract values, and can be expressed in text form using names, collective nouns, prepositions, or other words that can represent the concept. This analysis stage, SOP documents were analyzed using network analysis semantic techniques. The stages can be seen in Figure 1.

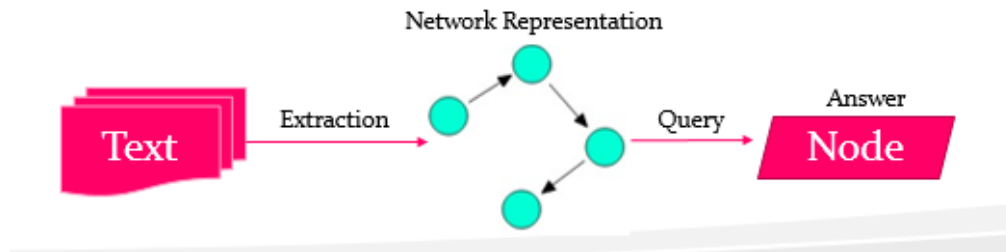


Figure 1. Semantic network analysis [5]

2.2. Design

In the analysis phase of software design to be built that is by using Class Responsibility Collaboration (CRC Card) and Spike Solution modeling using Unified Modeling Language (UML). The design of some UML modeling among others Use Case diagram, Activity diagram, Sequence diagram, and Class diagram.

1. CRC Card used to pay attention to the business process as a whole by dividing the classes that show the needs and responsibilities of levels created by the attributes used [11].
2. Use Case diagram used as a flow of user activity (user) against the software to be built.
3. An activity diagram is an extension of the use case that generates a workflow performed on the system by the business process to developed; they will translate into a user interface or user interface on the software to be built.
4. Sequence diagram will make according to the flow of the previous activity diagram; the sequence diagram will illustrate how the system processes the data in the form of input so that it becomes an output as expected. The sequence diagram was done as a drawing material for program flow or program algorithm to the system to be developed.

2.3. Implementation

This stage is an application of all the design results that have previously made into the actual form Designs that have created are implemented using a web-based programming language using the implementation of the CodeIgniter framework. Management Information System Knowledge SOP document personnel section UNSIKA made web-based to integrated with SIPEG UNSIKA. The system will be built with the addition of web service implementation to be able to exchange data between two systems to be integrated. In this case to support data exchange between the two methods used Rest API.

2.4. Testing

There are two tests at this stage; they are a Unit test and Acceptance test. A unit test is a test performed on the source code that has created by the programmer who wrote part of the program unit. A unit tests do because the programmer was familiar and memorized with the internal details of the group. The purpose of unit testing is to make the programmer satisfied that the program unit works as expected [12]. While acceptance testing is a formal test conducted to determine whether the system meets the criteria of the recipient [13].

In this study, testing is done more to the test of the functionality created by the software to built whether appropriate or not with the needs of the user. Testing is done using black box testing.

3. Result and Analysis

3.1. Results of Semantic Network Analysis

Semantic analysis conducted on SOP documents in the field of personnel section UNSIKA 25 papers. The investigation is done to determine some property, and knowledge relation exists in each SOP document. The knowledge property represented as a relief object (node) with the SOP name as the primary node. Then the knowledge relation is described as a relationship that appears to explain the interrelationships between nodes.

Figure 2 is a semantic illustration of the interrelationships between classes created in representing SOP documents. SOP dispositions that will make based on different employee

positions. One SOP document can perform by more than one type of situation, and vice versa one kind of area is responsible for carrying out more than one procedure.

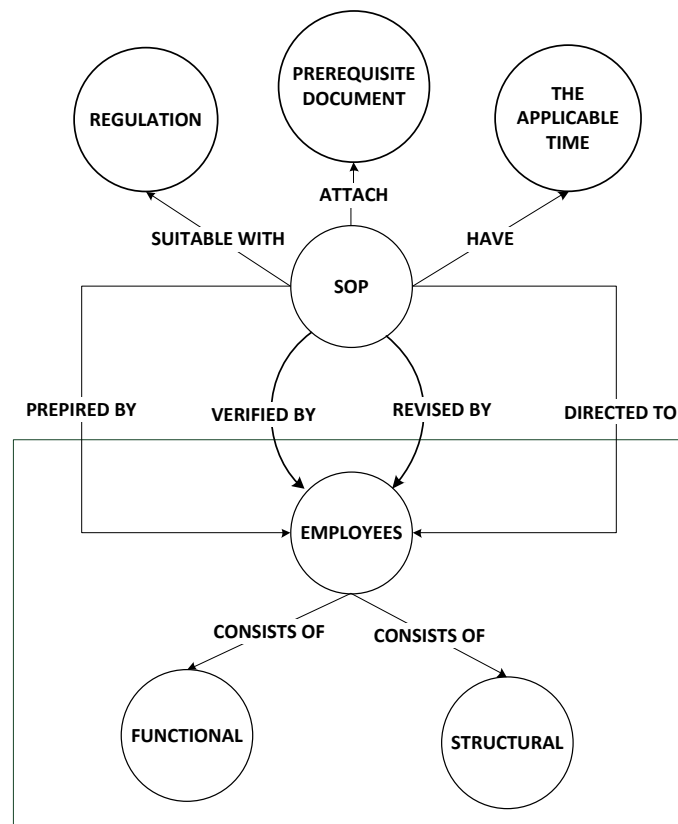


Figure 2. Semantic illustration of SOP UNSIKA

Whereas Table 1 defines source nodes that have destination nodes corresponding to the relationships that created. SOP is a source node that has five connections connected to the employee position. While the employee node has two contacts that divided into academic employees and structural employees.

Table 1. List of Semantic Relations to be Used

No	Relation	Source Node	Destination Node
1	PREPIRED BY	Related SOP	Employee
2	VERIFIED BY	Related SOP	Employee
3	CHECKED BY	Related SOP	Employee
4	REVISED BY	Related SOP	Employee
5	DIRECTED TO	Related SOP	Employee
6	ATTACH	Related SOP	Document requirements
7	SUITABLE WITH	Related SOP	Regulations
8	CONSISTS OF	Employee	Functional & Structural

3.2. Results of Design Analysis

The design of the system created by using UML modeling to support the design process done in more detail. Integration Knowledge Management System SOP with SIPEG users are public users (Pegawai) and Administrators (Administrator). Public users can receive SOP distribution according to the position that appears on the SIPEG account page. Administrator can manage SOP document in Knowledge Management System SOP. Use case diagram can is

used to show the different types of users and the relation with the system [14]. Use case diagram is shown in Figure 3.

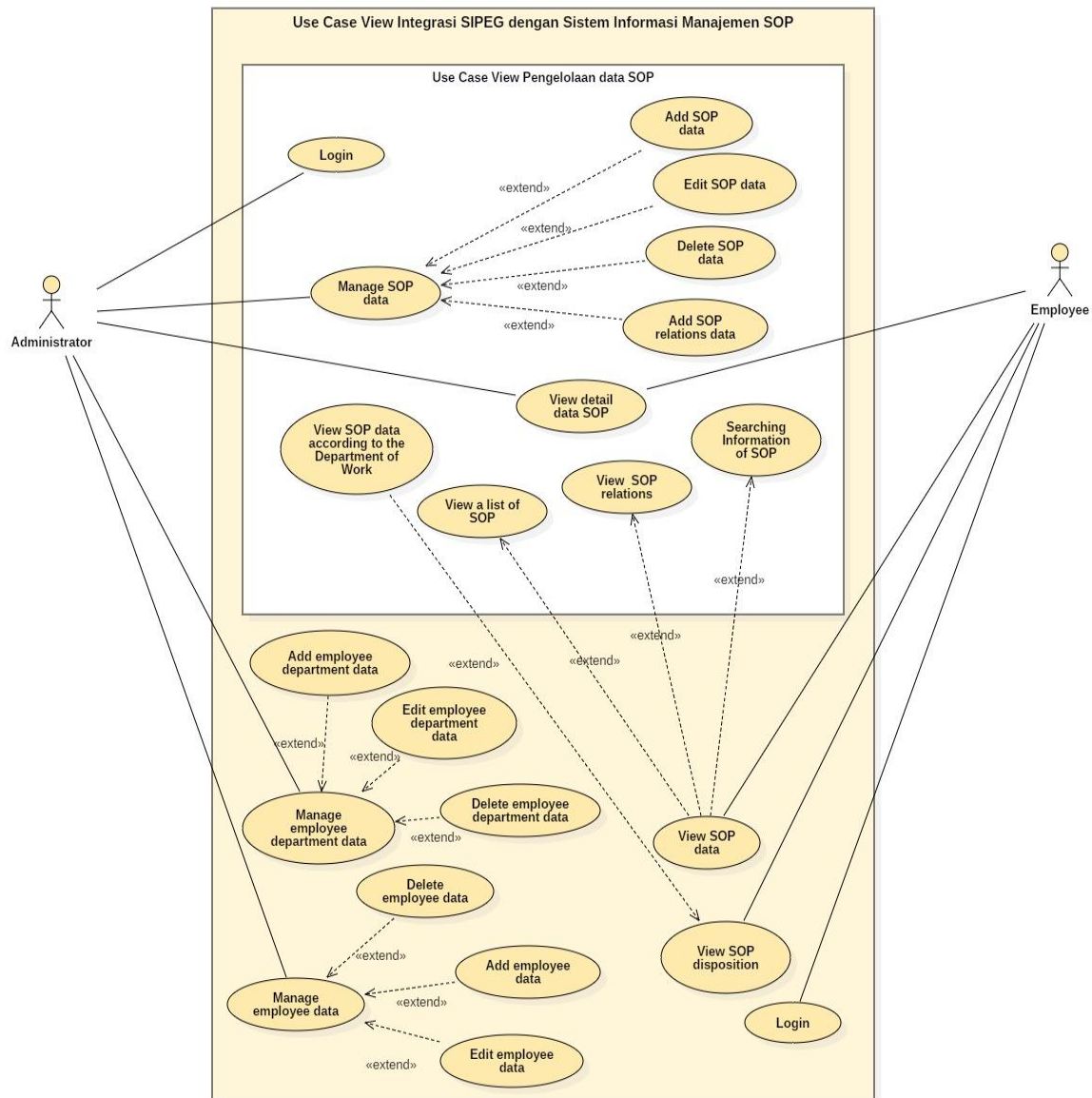


Figure 3. Integration system knowledge management system SOP with SIPEG use case diagram

3.3. Results of Implementation System

The results of system implementation are the stages of coding the program of the design that has created. The program code is implemented using the PHP programming language with the application of the CodeIgniter framework. The program code that has produced in some application interface that is the SOP knowledge management system that runs itself. The results from semantic network representation SOP can be seen in Figure 4. On this page display components of knowledge and their relationships obtained in one SOP document from the results of the analysis using a semantic network. While the hierarchical relationship between SOP documents can be seen in Figure 5.

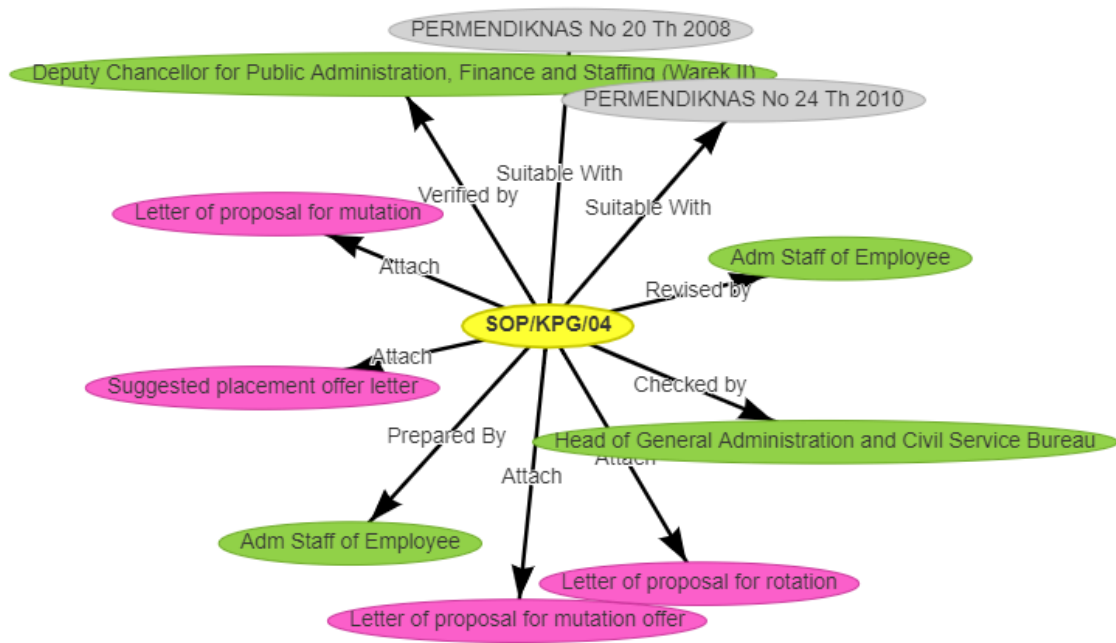


Figure 4. Semantic network representation SOP UNSIKA

Knowledge Management System SOP UNSIKA Logout

Document Master Data Semantic SOP Representation

Document Relation

DEPARTMENT

- Chancellor Head
- Wvice Rector of Academic Section (Warek I)
- Deputy Chancellor for Public Administration, Finance and Staffing (Warek II)
- Deputy Chancellor for Student and Alumni Affairs (Warek III)
- Deputy Chancellor of the Cooperation Section (Warek IV)
- Professor Senate
- University Senate
- Faculty Leadership Senate and Dir. Postgraduate

Figure 5. Displaying knowledge management system SOP.

SOP dispositions immediately appear on the SIPEG UNSIKA page shown in Figure 6. On this page display an example of an employee who has a structural position as the head of the Laboratory and as a Lecturer. The employee can see the SOP menu which automatically displays SOP relations that are mutually connected according to their position. This makes it

easier for employees to get SOP distributions that must be obeyed during their positions. SOP details for more details can be seen directly by employees. In addition, employees can upload SOP documents and prerequisite forms contained in SOP documents.

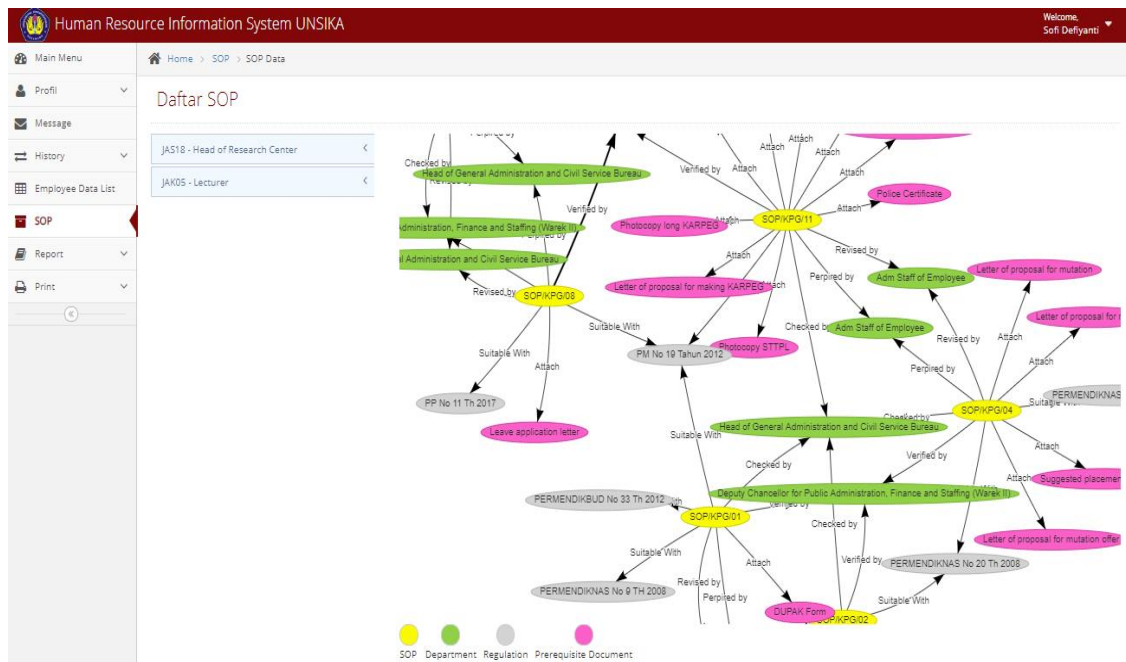


Figure 6. Displaying knowledge and disposition SOP in SIPEG UNSIKA.

3.4. Result of Testing System

Testing is performed on the functions contained in the system using black box testing. Test results can be seen in Table 2.

Table 2. List of Black Box Test Results on the System

Function	Location	Test scenario	Expectation	Test Result
Function Login	SOP Management login page	Input username and password	If invalid username and password input appears on the main page, otherwise an error message appears	Succeed
Function Add Data SOP	SOP Data Management Page	Input new data SOP	If input data is appropriate then SOP data stored in the database, if the information is not relevant will display an error message	Succeed
Function Update Data SOP	SOP Data Management Page	Input new data SOP	If input data is appropriate then SOP data stored in the database, if the information is not applicable will display an error message	Succeed
Function-Delete Data SOP	SOP Data Management Page	Selecting data SOP will be delete	SOP data deleted from Database	Succeed
Function Show List Data SOP	SOP Data Management Page	Success to login	Automatically display all SOP data list	Succeed
Function Show List Detail Data SOP	SOP Data Management Page	Selecting data SOP	SOP details data page is view according to the selected information	Succeed
Function Search Data	SOP Data Management Page	Input keyword	If evidence found then appear SOP data by the keyword, If not showing a notification message	Succeed
Function Show Disposition Data SOP	SIPEG user page	Selecting SOP menu	Automatically will display SOP list and SOP relation details according to user position	Succeed

4. Conclusion

This study aims to create a SOP knowledge management system by implementing semantic networks in analyzing hierarchical relationships between SOP documents. The SOP knowledge management system is then linked to the UNSIKA staffing system (SIPEG) so that employees get SOP documents that are distributed according to their position. This study resulted from the analysis of 25 SOP documents which contained 6 types of knowledge nodes from 1 document and there were 7 relations that connected certain nodes.

Employees need SOP documents to support their work to be in accordance with the procedures applied by a particular agency. Therefore, this system can facilitate employees in accessing SOP documents in real time directly into the SIPEG UNSIKA employee account. Semantic network is used in the search for SOP documents, because the results of the application of the SOP knowledge management system associated with the SIPEG UNSIKA make employees not need to look for SOP documents.

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