THE IMPLEMENTATION OF CASE BASED REASONING
IN KNOWLEDGE MANAGEMENT OF NURSING
AT HOSPITAL DUSTIRA CIMAHI

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ABSTRACT

Inpatient Installation is one part of the organizational structure of Dustira Cimahi Hospital which has the task of managing nursing knowledge in the hospital. The knowledge management system in nursing that runs at Dustira Hospital is still not running optimally, this can be seen in the difficulty of finding knowledge that will be used later as a solution to overcome problems in the nursing field. Nurses' knowledge sharing activities are not optimal due to the lack of containers and mechanisms, resulting in the knowledge that each nurse has is not integrated. Based on the problems outlined above, we need a system that can store, absorb, disseminate, and update knowledge for the field of nursing by implementing a knowledge management system. The process of knowledge conversion is carried out with the SECI process (socialization, externalization, combination and internalization). The process of utilizing knowledge using the case-based reasoning (CBR) method with the case-based reasoning stages, namely retrieve, reuses, revise and retain in searching for nurses' experiences. Calculation of detection of experience using similarity equations which have weight and similarity values. Based on the results of black box and beta testing that has been done, it can be concluded that this system has passed the functionality test and is able to help the nurses to find solutions to solve nursing problems and conduct knowledge sharing activities between nurses.

Keywords : knowledge management, SECI, case-based reasoning (CBR).

1. INTRODUCTION

Dustira Hospital is a hospital in the Cimahi city, West Java. Currently this hospital has a total of 374 nurses Road and Inpatient Installation including 8 Army Nurses, 57 Nurse of State Civil Apparatus, and 309 Temporary Daily Work Nurses. As health care institution, Dustira Hospital has a primary focus on primed health services and to improve it so the hospital always follows the development of science, one of them is the nursing field. One of ways to follow the development of science is by sharing knowledge among personnel nursing.

Management of nursing knowledge which is currently running at Dustira Hospital involves several outpatient installation and inpatient installation rooms where the nurses will perform nursing actions based on Standard Operating Procedures and responsibilities according to position in the nursing field that are knowledge in Standard Operating Procedures work, Standard of Nursing Care, material training, experience and patient management solutions. Because in managing existing knowledge is still found a problem that it is difficult to store existing knowledge both knowledge nursing field and field experience that are inappropriate, so the solution of this problem is it should be a place to maintain knowledge that already exists so it can be used for long time for both senior nurses and junior nurses, how to create knowledge that is relates to the nursing field both in terms of service and how to get solutions of problems, and how to renew existing knowledge or adding new knowledge related to the nursing field.

Knowledge Management can be interpreted as a technology to accelerate the growth of knowledge innovation by facilitating nurses to get the knowledge they need at the right time, accelerating the growth of tacit which can be interpreted as knowledge that is difficult to transfer to others, does not mean it cannot be transferred, but needs a long time in the process of transferring this knowledge and explicit knowledge of knowledge that has been documented which means it has been recorded or stored in a database, and can be learned by everyone directly and facilitates the process of transforming knowledge from tacit knowledge into explicit knowledge.

Knowledge management system is needed to provide solutions of problems that occur in the nursing field so as to facilitate the transfer of available knowledge or owned by nurses, provide a place for sharing in the form of discussion forums between nurses, provide the media to store important files related to nursing, and provide convenience in determining the solution of the case that is happening. AI (artificial intelligence) is needed for the search for solutions and knowledge management, especially in the problems faced by nurses, in this application

using an expert system, the expert system used is case base reasoning (CBR). Case base reasoning (CBR) is used to determine the nursing plan solutions of nursing problems, in order to make it easier to determine the nursing plan of the nursing problems being faced by nurses.

The basis of CBR (Case-Based Reasoning) is to imitate human abilities, namely by solving new problems using answers or experiences from old problems. The way CBR works is by comparing new cases with old cases, if the new cases have similarities with old cases, CBR will provide answers to old cases for the new cases. If there is no match, the CBR will adapt, by entering the new case into the case base database.

Based on current problems in the nursing field of Dustira Hospital, a knowledge management system is needed in the web-based nursing field.

1. Make it easy for the Dustira Hospital nursing and nursing committee to manage knowledge in the form of work procedures (SPO), training materials, experiences and patient management solutions so that existing knowledge is easy to use (Disseminate Knowledge), easy to store (Store Knowledge), easy managed (Manage Knowledge), easily created (Create Knowledge), easily updated (Capture Knowledge) and existing knowledge arranged in a tree of knowledge (Refine Knowledge).

2. Make it easy for nurses to find the best nursing plan of patient problems in outpatient and inpatient services based on previous cases.

2. RESEARCH CONTENTS

2.1 Theoretical Basis

The theoretical basis is upheld so that the research has a solid foundation. the theoretical basis for writing this thesis explains the theories related to the knowledge management system at Dustira Cimahi Hospital.

2.1.1 Theoretical Basis

The information system consists of two words, namely the system and information. The system is a network of interrelated procedures, gathered together to carry out an activity or to complete a specific goal. Information is interpreted as data that is processed into a form that is more useful and more meaningful for those who receive it. Information system is a system within an organization that meets the needs of daily transaction processing, supports operations, is managerial and strategic activities of an organization and provides certain external parties with the necessary reports, provides all information that affects all operations of the organization. [2]

2.l.2 Definition of Knowledge

One of the advantages of an organization is caused by the ability to create and utilize knowledge.

Knowledge is the whole piece of existing knowledge and individual skills used to solve problems. This knowledge is divided into theories and practices which are generally in the form of rules and instructions for making decisions. Knowledge depends on the data and information possessed by a person that reflects an opinion. The addition of knowledge in the perspective of knowledge management is basically oriented to the addition of knowledge. For example, by getting, searching, giving birth, creating, capturing and collaborating. [3]

2.l.3 Knowledge Cycle

Knowledge consists of two types, namely tacit knowledge and explicit knowledge. Tacit knowledge is knowledge that remains in the minds of humans in the form of intuitions, judgment, skills, values and beliefs that is very difficult to formalize and share with others. Explicit knowledge is knowledge that can or has been codified in the form of documents or other tangible forms so that it can be easily transferred and distributed using various media. Explicit knowledge can be formulas, audio and video tapes / CDs, product specifications or manuals.

Both types of knowledge, by Nonaka and Takeuchi (1995) can be converted through four types of conversion processes, namely: socialization, externalization, combination and internalization. These four types of conversion processes are called SECI Process (S: socialzation, E: externalizations, C: combination, and I: internalization) as depicted in Figure l.
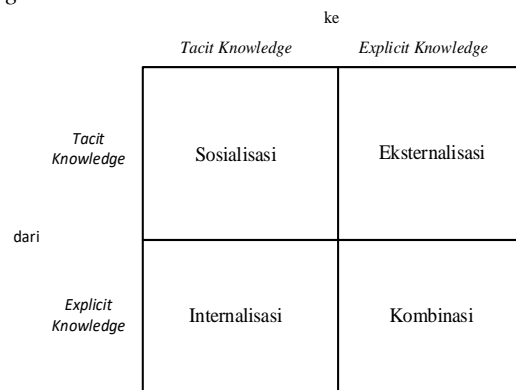

Figure 1. SECI Model

An explanation of the SECI model knowledge conversion model is: [5]

1. Socialization is <process> sharing> and creation> tacit = knowledge through direct interaction and experience.
2. Externality is still the articulation of tacit knowledge into explicit knowledge through processes of dialogue and reflection.
3. Combination is the process of converting explicit knowledge into new explicit knowledge through systematization and the application of explicit knowledge and information.

4. Internalization is a process of learning and knowledge acquisition that is carried out by members of the organization to explicit knowledge that is spread throughout the organization through its own experience so that it becomes the Knowledge Knowledge of Organizational Members.

2.l.4 Knowledge Management (KM)

The understanding of knowledge management is the management of organizational knowledge to create value and produce competitive advantage or excellent performance. Through knowledge management, the organization consciously identifies the knowledge it possesses and uses it to improve performance and produce various innovations. [6]. The application of knowledge management cannot be separated from 3 components, namely people, process and technology.

2.l.5 Case Based Reasoning (CBR)

Case Based Reasoning (CBR) is a problem solving technique based on past experience knowledge [3]. Description of CBR type as a circular process consisting of the four Res [4] :
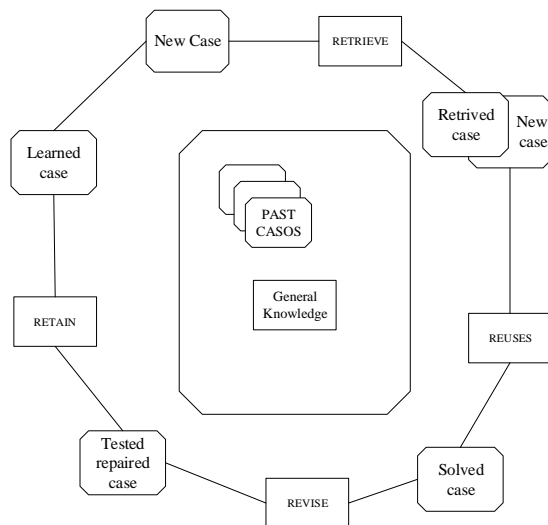

Figure 2. Case Based Reasoning Cycle

l. Retrive

Get similar cases compared to a collection of cases in the past. It starts with the stages of recognizing the problem and ending when the case you want to look for a solution has been found similar to an existing case.
Stages in this retrieve include:
a. Identify the problem
b. Starting matching
c. Selecting
2. Reuses
Reuse existing cases and try to solve a problem now. Reuses a case in the context of a new case is focused on two aspects, namely: the difference between an existing case and a new case and which

part of the retrieve case can be used to reuse an existing case, namely: reuses the solution of an existing case (transformatial) reuses) or reuses existing case methods for creating solutions (derivative reuses).
3. Revise
Change and adopt a solution offered if necessary. There are two tasks from this stage, namely:
a. Solution evaluation is how the results obtained after comparing the solution with the actual situation. This is usually a stage outside the CBR system. At this evaluation stage it often takes a long time depending on what application is being developed.
b. Correcting an error is the difference in a case involving identifying the error from the solution made and taking or making an explanation of the error.

4. Retain
Keep using the latter solution as part of a new case. At this stage there is a process of merging from a true new case solution into existing knowledge. Searching on this system uses the similarity technique (problem, case) as follows:

$$Simililarity = \frac{[(S_l*W_l)+(S_2*W_2)+(S_3*W_3)+\cdots+(S_n*W_n)]}{W_l+W_2+W_3+\cdots+W_n} \quad (l)$$

Where :
S = similarity value
W = weight value

2.2 Analysis
2.2.l Knowledge Analysis
Knowledge analysis builds on the SECI model. The application of the SECI model to the knowledge management of the Cicendo Bandung SlB State can be seen in Figure 3.3 with the following explanation:
a. Socialization (Tacit to Tacit) is the process by which nurses discuss or have a conversation. This process is found in the Forum media.
b. Externalization (Tacit to Explicit) is the process by which nurses make a note or writing about nursing actions and if processed in the process of experience. This process is in the added experience menu.
c. Combination (Explicit to Explicit) is the process by which nurses make a writing about the nurse's experience and then the article is shared with other nurses in the form of a module file. This process is in the action experience menu.
d. Internalization (Explicit to Tacit) is the process by which nurses apply the available experience when searching for solutions to patient problems. This process is in the process of finding a solution.
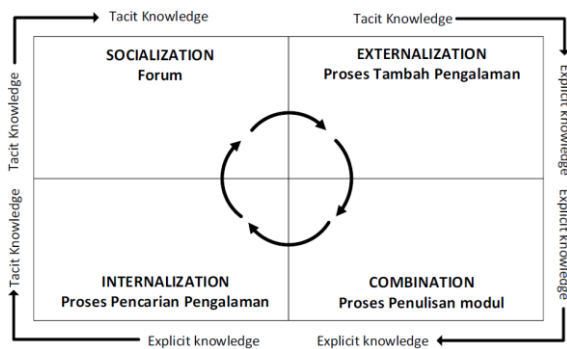
Figure 3. SECI Modeling of the Dustira Cimahi Hospital Management System

2.2.2 Experience Search Analysis

This stage is done with the intention to find out the problem solving to determine the learning method based on knowledge from previous cases using CBR analysis (case based reasoning).

The following cases that have been identified based on cases that have occurred in the past can be seen in table 1.

Table l. Nursing Case

Kode Kasus	Kasus
P0l	Nyeri
Pll	Gangguan Pertukaran Gas
P08	Risiko Syok

2.2.2.l Determine Nursing Cases that Are on a Case Base

The steps taken in determining nursing interventions / plans that exist on a case basis are retrive and reuse. This is because the solution has been found on a case basis so there is no need to revise and retain stages. Explanation of the steps taken is as follows.

1. Retrive

Matching is done by selecting complaints. Tracing on this system uses a similarity technique (problem, case), referring to chapter 2 equation 2.2.

Comparison of main complaints and weight values of cases P0l, Pll, P08 with new cases can be seen in tables 3.5, 3.6, 3.7, 3.8. Calculation of similarity based on the degree of similarity of new cases to cases that already exist in the system. The result of the analysis is that the system issues recommended solutions according to complaints selected by nurses.

The case which has the lowest similarity weight is case ID P08 has a similarity level of 0, 1 or 10%, then ID Pll has a similarity level of 0.l or 10%, then ID P0l has a similarity level of 0.9 or 90%. Case ID P1, has the highest level of similarity, 0.9 or 90%.

2. Reuse

Case ID P1 which has the highest level of similarity. The result of calculation with weight indicates 90% similarity level where the result is the highest similarity level compared to other case base IDs, so the solution can be given directly by using

nursing intervention / plan ID P0l. Nursing interventions / plans that can be used can be seen in table 2.

Table 2. Existing Case Solutions

The Solution	Observation - Identify the location, characteristics, duration, frequency, quantity, intensity of pain Therapeutic - Give non-pharmacological techniques to reduce pain Education - Explain the causes, periods, and triggers of pain Collaborative analytical giving, if necessary

2.2.2.2 Determine Nursing Cases That Don't Exist on a Case Base

The steps taken in determining nursing interventions / plans that do not exist on a case basis are retrive, reuse, revise and retain. Solutions cannot be given directly but instead proceed to the revision stage when the process of retrive and reuse of new cases does not have the same case indicator as the case indicator on a case basis. Revisions are made by the committee section in new cases. The knowledge base will continue to get improved if other different cases are found. Explanation of the steps taken is as follows.

i.   Retrive

Matching is done by selecting a complaint in the case. Tracing on this system uses a similarity technique (problem, case), referring to chapter 2 equation 2.2. Comparison of the main complaint and the weight value of cases P0l, Pll, P08 with new cases. The analysis result is that the system issues a recommendation in accordance with the results of the case Y similarity to the case base. New cases chosen by users (nurses) that are not on the case basis.

ii.   Reuse

The case that has the lowest similarity weight is case ID P0l, has a similarity level of 0 or 0%, then ID Pll has a similarity level of 0 or 0%, then ID P08 has a similarity level of 0 or 0% can be seen in table 3.

Table 3. New Case

Case Name	New Case
Complaint	Nutritional imbalances, impaired nutrient intake, decreased appetite
The solution	There is no solution yet

iii.   Revise

Cases that do not exist on the basis of the case will be processed in the revision or revision stage where the new case is revised to renew the existing case base carried out by the committee. The knowledge base will continue to get improved if other different cases are found. Case Y is a case that passed the revised case because case Y is a case that does not exist on the basis of the current case.

Left column

Table 4. Revise New Case

| Case Name	Nutrition
Complaint	Nutritional imbalances, impaired nutrient intake, decreased appetite
The Solution	Identify nutritional status, serve food in an interesting way, teach programmed diets, collaborate with nutritionists to determine the number of calories and types of nutrients needed, if necessary

iv. Retain

The retain process that is storing new cases, old cases or case bases where the case base is repaired will be stored as knowledge data. Following cases - cases that are on a case basis can be seen in table 5.

Table 5. Nursing Case

| Case Code	Case
P0l	Pain
Pll	Gas Exchange Disruption
P08	Shock Risk
P03	Nutrition

2.3 Database

Designing data using entity relationship diagrams. Relationships between knowledge management system entities in Dustira Hospital have 13 entities which can be seen in Figure 4.
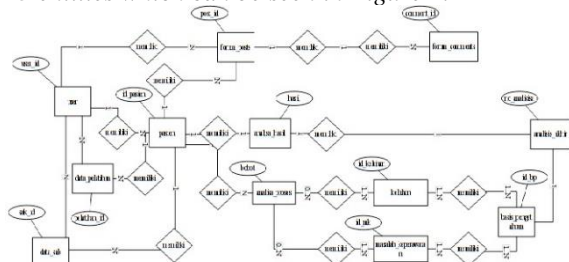
Figure 4. Entity Relationship Diagram of Dustira Hospital Knowledge Management System

2.4 Context Diagram

Context diagram is a diagram that consists of a process that describes the scope of a system there are 2 users between the committee and the nurse. The context diagram of the knowledge management system in Dustira Cimahi Hospital that will be built can be seen in Figure 5.

Right column
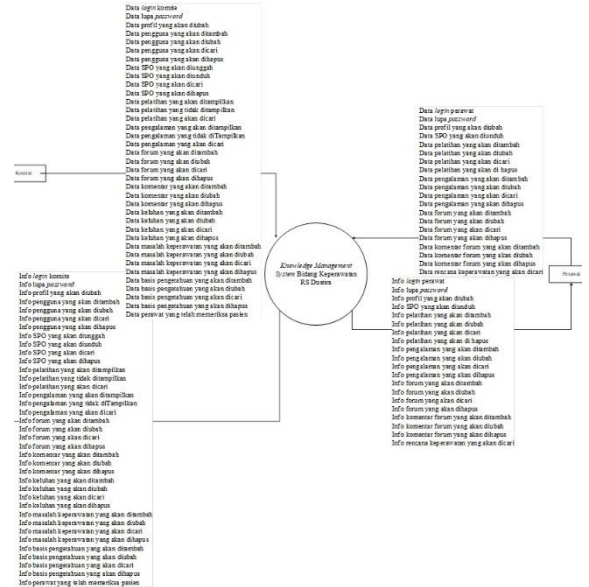
Figure 5. Dustira Hospital Knowledge Management System Context Diagram

2.5 Data Flow Diagram (DFD)

Data flow diagrams are models of the system to illustrate the division of systems into the smallest modules. DFD level l can be seen in Figure 6.
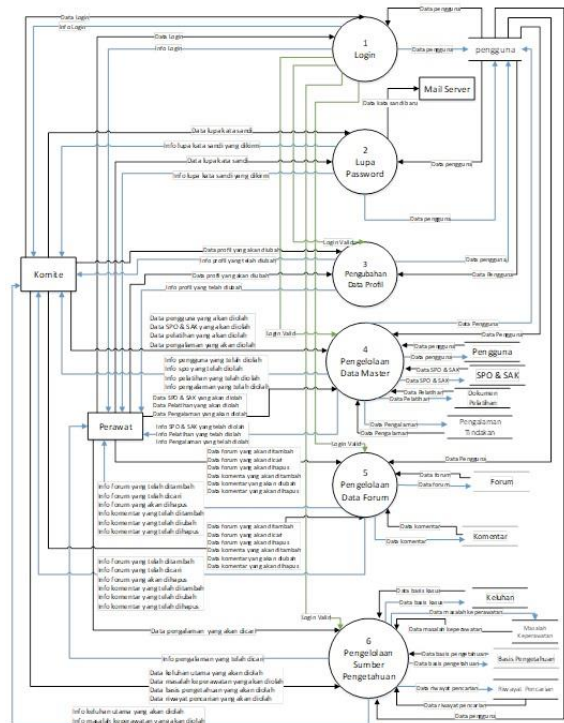
Figure 6. DFD level l Knowledge Management System Dustira Cimahi Hospital

2.6 Relationship Diagram

Diagran relation is used as a liaison relationship between two or more tables in the system. The table holds or contains data on the system. Relationship diagram in Dustira Hospital Knowledge Management System can be seen in Figure 7.
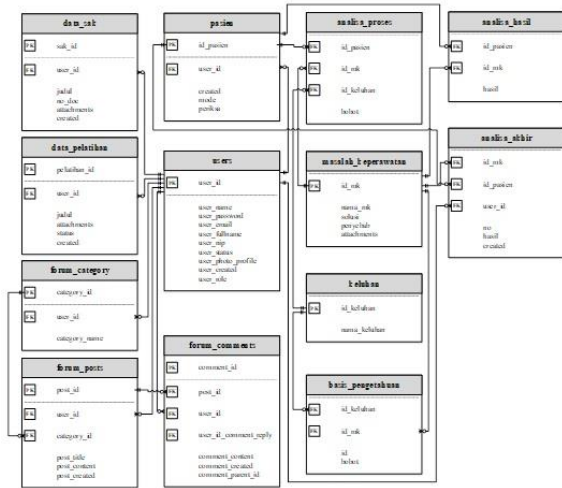
Figure 7. *Relationship diagram of Dustira Hospital Knowledge Management System*

2.7 Menu Structure Design

Menu structure design is a menu structure that is designed in general. The design of the menu structure in Dustira Hospital's knowledge management system can be seen in Figure 8.
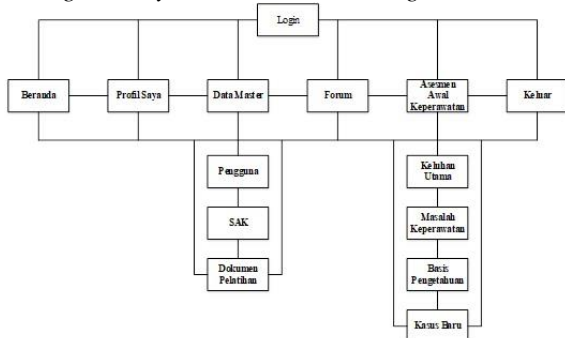

Figuure 8. *Menu Structure of the Dustira Cimahi Hospital Knowledge Management System*

2.8 Semantic Network Design

Semantic network design is an illustration of interface design based on DFD. The semantic network design of the Dustira Cimahi Hospital Knowledge Management System can be seen in Figure 9.
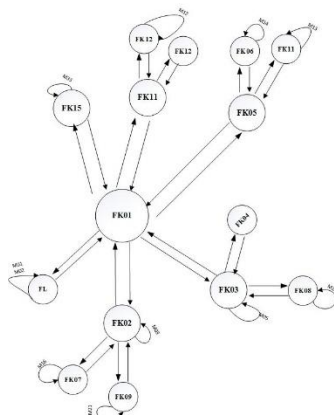

Figure 9. *Semantic Network Design for Knowledge Management System Dustira Cimahi Hospital*

2.9 Procedural Design

Procedural design is a chart that illustrates the workflow in a procedure that combined with each other to form a system. Procedural design consists of login procedures, add data, change data, delete data, upload data and download data. Procedures for Nursing Case Search can be seen in Figure 10.
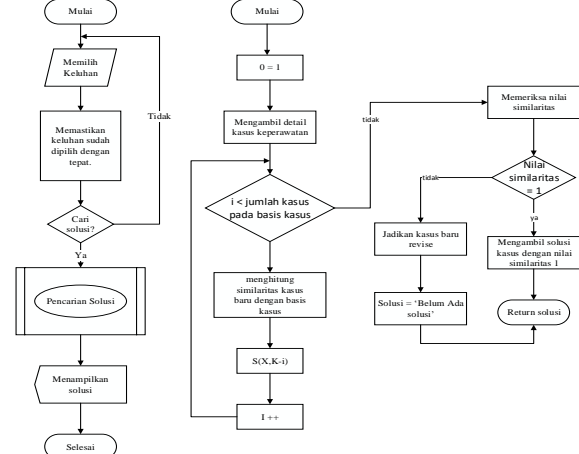

Figure 10. *Flowchart Searching for Case-Based Nursing Experiences*

2.l0 System Testing

The test used to test the new system is the black box testing method. Black box testing is focused on testing the functional requirements of the information system. Testing to be done is to test the system that was built in black box and beta. Testing the development of knowledge management at Dustira Cimahi Hospital uses test data based on the data provided.

1. Black Box Testing

Black box testing is focused on the functional requirements of the software being built. Dustira Hospital's knowledge management testing was carried out in each section for possible errors. The black box testing scenario can be seen in table 6

Table 6. *Login Data Testing*

Cases and Test Results (Correct Data)			
Input	**Which are expected**	**observation**	**Result**
Example input NIP : 02l603l765 Password : 25lll994	Fill in the login data that has been registered	The login data is correct and the user will enter each of the home pages specified by the system according to the user's access rights.	[√]be accepted [ ] rejected

Cases and Test Results (Incorrect Data)			
Input	Which are expected	observation	Result
Example input Username : alisson Password : becker	Notification "Oopss ! Sepertinya Akun Yang Anda Masukan Tidak Terdaftar."	Notification "Oopss ! Sepertinya Akun Yang Anda Masukan Tidak Terdaftar."	[√]be accepted [ ] rejected
Kasus dan Hasil Uji (Data Kosong)			
Data Masukkan	Yang Diharapkan	Pengamatan	Kesimpulan
Example input Email : Kata Sandi :	Notification "Harap isi bidang ini"	Notification "Harap isi bidang ini"	[√]be accepted [ ] rejected

Table 7. Nursing Experience Testing Test

Cases and Test Results (Correct Data)			
Input	Which are expected	observation	Result
Example input : Nama keluhan: Penurunan nafsu makan	Displays experience data in search	Displays experience data in search	[√]be accepted [ ] rejected

Based on the results of testing with test sample cases that have been conducted on the knowledge management system in the nursing field at Dustira Hospital, it concludes that the process is as expected. Screening process errors in the form of messages that appear are quite maximal. Functionally the system can be considered to meet the expected needs.

2. Beta Testing

Beta testing is a direct test. The user evaluates the software using the interview method. From the results of the interview it can be concluded whether the software that was built was in accordance with the objectives or not. Following are questions and answers from Ms. Awaliah Widianisa S. Amd.Kep as a nurse at Dustira Cimahi Hospital who will be a user as a nurse in knowledge management at Dustira Cimahi Hospital.

Table 8. Nurse Interview

Pertanyaan	Jawaban
Does this system manage SPO well?	Ms. Awaliah Widianisa S. Amd.Kep said that managing SPO on the system was good.
Does this system manage the training material well?	Ms. Awaliah Widianisa S. Amd.Kep said that processing the training material on the system was good
Does this system manage the experience of action well?	Ms. Awaliah Widianisa S. Amd.Kep said that managing the experience of actions on the system was good.
Does this system manage the forums properly?	Ms. Awaliah Widianisa S. Amd.Kep said that the forum management was good
Does this system manage case analysis well?	Ms. Awaliah Widianisa S. Amd.Kep said this system was good at managing existing case analysis
What do you think of the use of language on this system?	Ms. Awaliah Widianisa S. Amd.Kep said the language on the system is easy to understand
What do you think about the ease of use of this system?	Ms. Awaliah Widianisa S. Amd.Kep said the system was easy to use
What do you think about the appearance of this system?	Ms. Awaliah Widianisa S. Amd.Kep said the system display was quite good.

Based on beta testing that has been done before, it can be concluded that the system in terms of functionality has met the needs of nurses based on research objectives. The overall system display is already said to be good.

3. CLOSING

3.l Conclusion

Based on the results obtained in making this final project, the following conclusions can be drawn:

1. The knowledge management system application in the nursing department at Dustira Hospital makes it easy for the nursing committee to manage knowledge in the form of Nursing Care Standards (SAK), Operaional Procedure Standards (SPO), training materials and experience so that existing knowledge is easy to use, easy to stored, easy to manage, easily created, easily updated.

2. The knowledge management system application for nurses at Dustira Cimahi Hospital makes it easy for nurses to find experience and determine the best intervention solution for nursing problems.

3.2 Suggestion

Based on the results that have been achieved in building a nursing knowledge management system at Dustira Cimahi Hospital, things that are expected in the future can be developed more widely, including:

1. *The application of knowledge management system in the nursing field at Dustira Hospital that has been built can be used as material for the development of services in other parts of the installation such as pharmaceutical installations, surgical room installations and patient examination poly.*
2. *Existing display is made more attractive and added other additional features.*

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