Design of Intermediate Medical Record Information System in Electricity Patient Using Rolap Warehouse Data

Made Dinda Pradnya Pramita[1*], Gde Brahupadhya Subiksa[2], and Komang Oka Saputra[3]
[1,2]Department of Electrical and Computer Engineering, Post Graduate Program, Udayana University
[3]Department of Electrical and Computer Engineering, Udayana University
*Email: brahupadhya@gmail.com

***Abstract* — Along with the development of information and communication technology (ICT), which has become a major influence for change in all sectors, including health, especially in medical records is called electronic medical record. Basically an electronic medical record is the use of electronic methods to collect, store, process, and access patient records in hospitals that have been stored in a multimedia database management system, bringing together various medical data sources. Often the problem arises there is no relationship between the respective health care providers in terms of information on the medical record. Although the patient may have a medical examination at a health care provider vary at a certain time. This leads to the same inspection occurring repeatedly. Whereas previous medical records are very useful in further medical examination. Of the several problems mentioned above have designed a centralized electronic medical record system that accommodates patient medical records in a centralized database for the purpose of patient records stored in a single database storage. So if one day the patient is registered in the system, if referred from one hospital to another hospital in the area, data can be viewed and accessed based on data from the hospital or health care provider who has joined in this system. With this system helps reduce the possibility of misdiagnosis.**

Keywords: Centralized Medical Record, Data Warehouse and ROLAP

I. INTRODUCTION

Along with the development of information and communication technology (ICT) that has a major impact on changes in all areas, including the health sector, especially in the medical record process called electronic medical record (Hozinah, 2010).

The problem that often arises when the medical record information system is still not integrated is the lack of linkage between each health care provider in terms of information on the medical record. Though patients may have a health check on different health care providers at a certain time. If there is no link between each health care provider, the same checks will occur repeatedly. Though previous medical record data is very useful at subsequent health checks. This greatly helps reduce the possibility of misdiagnosis.

The problem that often arises is the complaints of patients showing every time they enter the health care provider saying that they answer the same questions at each visit or diagnosis (Schafer, 2008). Patients complain about questions given by doctors at the time of diagnosis is almost the same. The point here is for example a patient who received referrals from a hospital to a hospital that has more adequate facilities, previously in the hospital of origin of the patient has been diagnosed complaints and illness suffered, but the hospital the patient's referral destination get re-diagnosis from the beginning again. This results in the same data collection of repeated diagnoses and medical record.

Of the several problems mentioned above need to be designed a centralized electronic medical records system that accommodates the patient's medical records in a centralized database. Centralized storage referred to here is a condition in which outpatient medical records and inpatient care are stored in a single file and in a storage database.

II. STUDY LITERATURE

A. *Data Warehouse*

Data warehouses are a concept and combination of technologies that facilitate organizations to manage and maintain historical data obtained from operational systems or applications [Ferdiana, 2008].

Some steps in the preparation of data warehouse are as follows.

1. Process Selection
   - The first data mart built is a data mart that can be sent in a timely manner and can answer all business questions.
   - The best choice of data mart is related to sales, property sales, property advertising and property leasing.
2. Grain Selection
   - Determine what is represented exactly and represented by a fact table.

- For example if the source of a property sale table is a private sale property then the source of the customer dimension is about the details of the customer who buys the main property.

3. Identify and adjust dimensions
   Dimensions set the context of fact-related questions in fact tables

4. Choose facts
   The grain of the fact table determines which facts can be used in the data mart

5. Storage of initial calculations in fact tables
   Each selected fact must be re-examined to determine if there is an opportunity for initial calculation

6. Completing the dimension table
   At this point, we will return to the table dimension and add explanations to the dimensions as much as possible Explanations should be understood by users or users

7. Selection of database duration
   Duration measures the extent to which fact tables can look back several years

8. Track dimensional changes slowly
   Dimension changes slowly

9. Specify query priority and query mode
   At this stage, we consider the design issue

B. *Electronic Medical Record*

Electronic medical records can be practically defined as the process of maintaining electronic health information about the health status and health care that has been given to patients (Ardianto, 2004). An electronic medical record is a tool that enables registered users to access information about patients and clinical decision support tools (Dewi, 2003). Electronic medical record is one of the advances in the field of information technology is very useful for health services, both hospitals and health clinics (Hariadi, 2004)

C. *ROLAP (Relational OLAP)*

ROLAP is an OLAP type that relies on a relational database or RDBMS (Relational Database Management System) as a storage medium for data to be processed. With this strategy the OLAP Server is protected from data storage management problems and only translate the query analysis (MDX) process to relational query (SQL). Automatic ROLAP optimization process will be largely determined on the RDBMS product side which is used eg from the handling side of the data amount and the indexing strategy.

Some of the advantages and disadvantages of ROLAP are as follows.

a. Advantage
   - Can handle large amounts of data volumes, the limit of the volume size of data handled on ROLAP technology is the limit of the volume of Relational Database used. In other words in ROLAP itself there is no data volume limitation.
   - Can take advantage of existing functions on the Relational Database used.

b. Deficiency
   - Performance can be slow, because each ROLAP report is basically SQL Query on the Relational Database, the query time can be longer if the data volume gets bigger.
   - Limited SQL functionality, because ROLAP technology depends mainly on establishing Query

Statements on Relational Database, and not all requirements are met with SQL Statement. ROLAP vendors have anticipated this risk by creating out-of-the-box tools for complex functions and even allowing users to define the functions they need themselves.

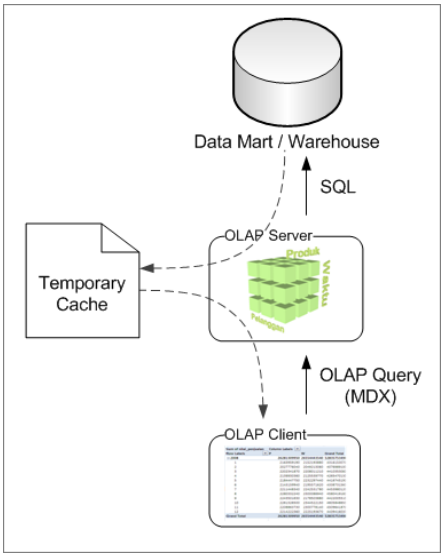


Figure 1 ROLAP Work Mechanism

The workings of ROLAP in general are as follows

1. OLAP client sends query analysis to OLAP Server.
2. OLAP server will perform a cache check whether it can serve query request from the client, if it will be sent.
3. If there is no data in the cache requested, SQL queries will be done to the data mart and the execution results are stored in the cache and sent to the client.
4. So on and so on.
5. Cache will be stored for a certain period of time and will be totally cleaned if the server is turned off.
6.

III. METHODOLOGY

A. Analysis

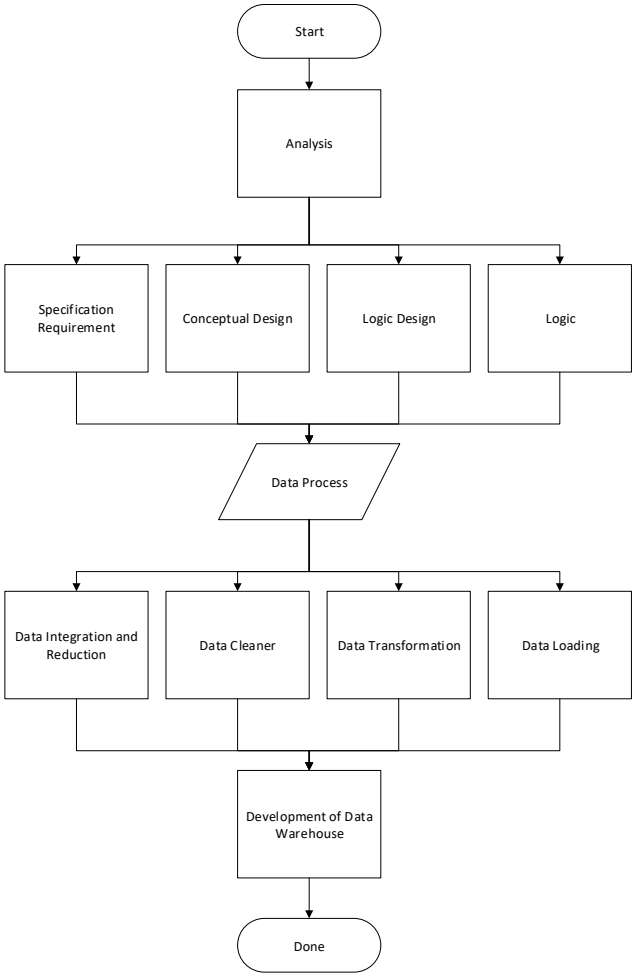
At this stage an analysis is done to determine the specification of data warehouse requirements that will be built

in accordance with the wishes. Specification of these needs will result in conceptual design, logical design, and physical design. The user for this system is part of the hospital's data manager.

From this application, is expected to provide some information, among others:

a. Formation of centralized recording data on one server
b. Formation of centralized recording data on one server
c. Each patient will have one medical record data although moving to a different hospital

The initial stage prior to the process of making data warehouse, conducted data collection and analyze the value and attributes to get the right attributes in the data warehouse. Once selected and known its attributes, then proceed to the data preprocess step.



B. Data Preprocess

Before entering into data warehouse creation, data must be processed first. Pre-process stages in medical record data are as follows.

- Data integration and reduction
  Integration is done by combining the interesting attributes of the table being analyzed. Reduction is done in conjunction with the integration process, by removing the less interesting attributes from the table being analyzed.

- Cleaning
  Data cleaning is done on inconsistent attribute data. The condition can be overcome by uniform its value..

- Transformation
  In this process is done by constructing new attributes using data from existing attributes.

- Data Loading
  At this stage, the data is ready to be loaded into the data warehouse. The loading stage aims to load the selected data into the destination data warehouse and create the required index.

IV. DISSCUSION

A. Decision Support System of Determination of Nutrition

In this decision support system used the KNN (k-Nearest Neighbour) method to determine the nutrition of patients based on the medical record data entered.

If there are 20 sample data used as a knowledge base for nutritional status based on height, weight, percent fat value, systolic blood pressure, diastolic blood pressure, heart rate, upper arm circumference, forearm circumference, abdominal circumference and pelvic circumference in Table 1.

Want to know the nutritional status of a person with height 175 cm, weight 67 kg, 23% fat, systolic blood pressure 97, diastolic blood pressure 67, heart rate 79 / minute, arm circumference 25 cm, circumference 15 cm, stomach 75 cm, circumference of the pelvis 95 cm. Based on KNN algorithm, calculation can be done as follows:

1. Determine the value of K, eg K = 5.
2. Calculate the distance of each sample data with student data to be tested

3. Next, the data is sorted by distance
4. If set value of K = 5, then taken 5 shortest distance.
5. In the first to fifth sequences, there are 4 Normal nutritional status and 1 nutritional status of Skinny, so for evaluation data r = (175, 67, 23, 97, 67, 79, 25, 15, 75, 95) included in nutritional status Normal

Table 1 Physical Condition Data Samples

People to-	Hospital to-	Height	Weight	% fat	Systolic	Diastolic	Heart rate	Upper arm	Forearm	Abdominal Circumference	Pelvic Circle	Nutritional status
I	1	159	58	23,4	118	75	64	26	15	70	85	Normal
	2	163	59	25,4	102	68	69	23	14	74	94	Normal
	3	165	73	29,1	105	67	75	28	18	83	100	Obesity
	4	166	58	19	128	69	69	26	16	79	100	Normal
	5	167	75	30,7	126	81	65	30	16	91	103	Obesity
II	1	169	79	22	123	76	70	29	17	84	101	Obesity
	2	169,5	55	15,2	112	77	70	22	14	75	92	Thin
	3	170	72	26,1	113	72	83	28	16	85	98	Normal
	4	172	68	22,8	110	65	68	27	15	79	94	Normal
	5	173	56	17,9	120	76	97	25	14	72	88	Normal
III	1	166	58	19	128	69	69	26	16	79	100	Normal
	2	168	73	22,7	107	73	81	30	18	77	96	Normal
	3	169	79	22	123	76	70	29	17	84	101	Obesity
	4	170	72	26,1	113	72	83	28	16	85	98	Normal
	5	172	68	22,8	110	65	68	27	15	79	94	Normal
IV	1	168	58	13,9	122	88	101	22	15	68	84	Thin
	2	169	79	22	123	76	70	29	17	84	101	Obesity
	3	170	72	26,1	113	72	83	28	16	85	98	Normal
	4	172	68	22,8	110	65	68	27	15	79	94	Normal
	5	173	56	17,9	120	76	97	25	14	72	88	Normal

Table 2 System Validity Test Results

Data to	DSS	Nutritional Status	Description
1	Normal	Normal	T
2	Normal	Normal	T
3	Obesity	Obesity	T
4	Normal	Normal	T
5	Obesity	Normal	F
6	Obesity	Normal	F
7	Thin	Thin	T
8	Normal	Normal	T
9	Normal	Normal	T
10	Normal	Thin	F
11	Normal	Normal	T
12	Normal	Normal	T
13	Obesity	Obesity	T
14	Normal	Normal	T
15	Normal	Normal	T
16	Thin	Thin	T
17	Obesity	Obesity	T
18	Normal	Normal	T
19	Normal	Normal	T
20	Normal	Normal	T

Information:
T = True. Occurs when the system results are the same as the sample data.

F = False. Occurs when the system results are different from the sample data.
Based on the validity test that has been done then obtained:

SKP Performance = number of test results true value / number of sample data
= (17/20) * 100
= 85%

The test results show that the system performance is good enough. The addition of sample data allows for improved system performance. By applying the concept to ROLAP then the data is displayed in graph form as follows

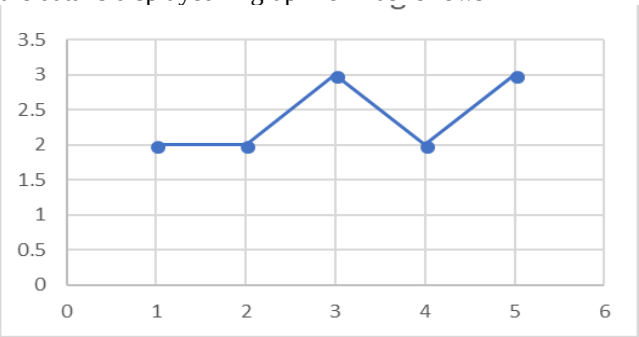
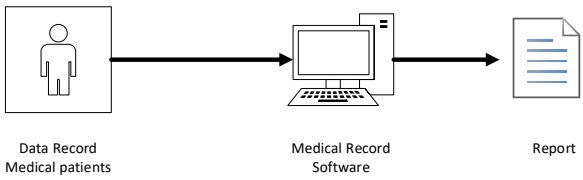


Figure 3 List of Nutrition Development

Figure 3 is an example of the application of patient medical record data related to the patient's nutritional development where the data comes from 5 different hospitals

B. Application of a Centralized Medical Record System Design

The recording of the patient's medical record includes patient's personal data and medical history data. The output (output) system can be a report according to the format and patient medical records database. If the patient is admitted to a hospital service unit, the patient's medical records database may be used by medical personnel during the next history.



In performing the function as a recording and reporting system of patient medical records, it has designed three main modules. The module is as follows

a. Module Recording of patient data
This module serves to record the patient's self data at the time of treatment at the hospital. Recording of data can follow the rules of the family folder that records the patient's medical record in one family recorded at the same registration number or separate folder with different registration number.

b. Module Recording of patient data
Physical examination data, anamnesis, and therapy for patients are listed in this module. Patient medical record data can be used as a consideration of medical personnel in providing therapy in the form of referral or prescription drugs. Records are performed by authorized medical personnel from the service unit in which the patient is hospitalized (general poly, dentist, MCH, nutrition and basic labs and other additional services).

c. Data Reporting Module
This module is used to generate reports from input (input) data that has been stored in the database server. The report type is tailored to the format and requirements of the Hospital

All input data is stored in the database on the server computer. The application database is described in the tables of mutually related data. Normalization rules are used in database design to form a good relational structure without redundancy. Thus the software database can be utilized for data sharing and data consistency.

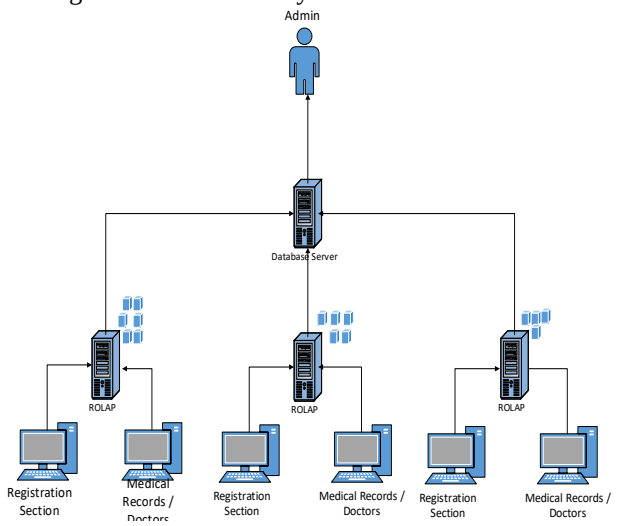


Figure 3 The Design of Centralized Medical Record Data

The design of the system architecture in the hospital is shown in Figure 3. The application software and database are stored in one server and in each service unit there is a computer device connected to the server using intranet network. Fungi registration of patients, in the form of recording on the first module software, run at the registration counter and implemented by the officer. The patient's personal data is stored in the database and followed by the second module recording by medical personnel in each health care unit. The medical examiner of the patient is authorized to perform the process of recording the data.

The steps performed in the preparation of centralized data recommendation applications are as follows.

1. Entering the patient's Data from the registration section and after that there is input data of medical parts from each hospital
2. Data from each hospital will be stored on the server of each hospital, then at this stage start utilization ROLAP data warehouse technique, which where the steps are as follows.
   a. OLAP client sends query analysis to OLAP Server.
   b. OLAP server will perform a cache check whether it can serve query request from the client, if it will be sent.
   c. If there is no data in the cache requested, SQL queries will be executed to the data mart and the results of the execution are stored in the cache and sent to the client.
   d. And so on
   e. The cache will be stored for a specified period of time and will be totally cleared if the server is shut down.

V. CONCLUSION

Based on the above discussion is expected that the system designed to meet the needs of the community, especially in the health world to have a centralized medical record data. If the medical record data is running centrally it is expected that when the patient switches the hospital then the data will be accessible wherever and whenever, so that could be the basis in taking action by doctors in other hospitals.

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