Distributed Data Patient In Medical Record Information System

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Abstract: System legislation - crustaceans in Indonesia require to make medical records for each patient visit to a medical center. Physician handwriting that is difficult to interpret by others at a hospital would cause much impact. On the other hand at the moment that is not possible, after a patient enrolled in a hospital, this patient could not continue the examination in the hospital before. The aim of this system is designed to produce a good concept of distributed systems on the network of hospitals and other medical centers. So it can be useful to facilitate patients in treatment wherever he wants and likes. Data were recorded on a medical center will be read at the medical center anywhere. The proposed system using a distributed network and SOAP methods. This method is used to synchronize the different database formats on the hospital network. The expected result is to be comfortable in the treatment of patients and did not occur mall where a very dangerous practice.

Keywords: *Medical Record, Database, Networking, Coud Computing, Distributed System, Networking, Health Record*

1.1. INTRODUCTION

When a patient comes to a hospital, clinic, physician practice or other medical centers, the registration section will be asked whether the patient had ever come or not. If the patient says it never comes then the officer will ask for Patient Medication Identification Card (KIB) which will be used to find relevant patient records. In the conventional health care, then the officer will use a tracer to locate patient records on a storage form of stacks of paper. If the patient is in a hospital is still a bit then it would be problematic, but if the patient has reached a massive scale in the amount of hundreds of thousands or even millions it would have caused problems. The next problem is when a patient who had been to a hospital and then visited another hospital, the same procedure will also be experienced by the patient. Of course this will slow down service. Doctors also difficult to find a history of the patient as a reference diagnisisnya. Permenkes 749a No. 1989 states that any health care facility shall conduct medical record. Medical Record (RM) is a file that contains records and documents about the identity of the patient, examination, treatment, action, and other services to patients in health care facilities. RM has the objective to support the achievement of orderly administration in the context of efforts to improve health services in the hospital. Implementation of RM in the hospital include patient admissions, medical and nursing services, administrative services and finance, RM data recording and reporting. **Permenkes No. 749a (1989)**

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2.1. Distributed Systems

Distributed computer system is a computer system that allows applications to operate in an integrated manner on more than one separate physical environment. Health information system consists of the components of a distributed application (in the doctor's office, in hospitals, in pharmacies and health insurance companies). Characteristic of distributed computer systems is heterogeneity in various ways: hardware, operating systems and programming languages. It is impossible to develop a homogeneous distributed systems compulsion, because naturally distributed computer systems grows from a heterogeneous environment. Keywords in bridging the differences that arise are interoperability. Lukito Edi Nugroho

2.2. Distributed Data Base

In the distributed database system data is stored scattered in several places. Each storage area is managed by a DBMS independent. In order to view transparent distributed database view, it must meet two things, namely independence atomisitas distributed data and distributed transactions. With the independence of distributed data, the user can perform a simple query without specifying where the data or the data replicas or fragments of data that is stored. This satisfies the principle of physical data independence and data logic or data logic is independent of physical data. Furthermore the query process should also take into account the cost of the physical data storage through data communication or stored as local data (replica). With a distributed transaction atomisitas users should be able to perform daily transactions, update or data access to distributed data, as if the data is stored locally. Effect of transactions on distributed data must be atomic, that is persistent changes to the remote data and local data if the transaction has been committed, or there is no change at all if the transaction fails (can not commit). Although in general both of these must be met, but the situation in case of heavy traffic and a delay of the transmission, it would require a special mechanism to handle relating to administrative overhead and performance DBMS

2.3. OLTP

Database management systems are widely used by organizations to manage operational data every day, such as reservation data, the data should be reliable safe and efficient. Applications OLTP (online transaction processing) in the last 3 decades continues to grow. Applications that can generate a

summary of data from the old data and the new, including applications for decision support or, as it can be used to assist in making organizational decisions appropriately. The need to see the data as needed (view) and the corresponding user criteria (query) which is extracted from complex data sets triggers to learn how to define efficient query before view. Phase determination of query is called a pre-computational view. For purposes of computing pre-view, then the information should be consolidated from multiple database types (multi-database) into the data warehouse tables by copying from multiple locations to a single location. An organization that can take the right decisions requires view all aspects of a comprehensive organization, therefore we need a data warehouse that contains data taken from all the organization's data base managed by each organizational unit. Many of the character traits of decision support queries which can not be handled by the system SQL (structural query language) adequately, such as: the WHERE clause contains too many conditional operator (AND and OR) that it becomes cumbersome. In addition, many applications that require statistical functions like standard deviation can not be handled by SQL, so the SQL query should diembedkan into another programming language. Some applications relating to time require temporal databases, there are also some applications that require deductive approach of multiple queries relating to support a decision.

2.4. Data Mining

Data Mining (DM) is the science that deals with how to find relevant information or knowledge from large databases once by using statistical and pattern rules automatically. In contrast to the search for knowledge with machine learning in the field of artificial intelligence the size of data stored on disk is not too large, then the size of the DM data stored on disk is very large. Search of knowledge there are two aspects of DM models, namely Model DM user who is directly involved in the search for knowledge, and knowledge of the search model of DM are completely handled by the system automatically. As the analysis and exploration tools, there is continuity between the query SQL, OLAP and DM. SQL queries are at the end, in the middle of OLAP and DM is at the other end. SQL queries are relatively simple compared to OLAP, query while the DM so complex that it requires a user defined parameters and the use of certain algorithms. On implementation of data on DM incomplete or contain noise. Exploration process knowledge or knowledge discovery process (KDD) can be divided into several stages. The early stages of data selection is to sort the raw data, then data cleaning is throwing phase noise and transformation of data values into a common unit, generating new attributes from existing attributes appropriate combination of relational schema. At the stage of data cleaning may also be done denormalisasi. In the next stage of the data mining stage of the real pattern extraction. In the last stage, the evaluation stage pattern visualized representation that is easy to understand the user, if required happened feedback to previous stages. Knowledge representation in DM using association rules: if antiseden then consequent (antiseden {} => {consequent}), which means that if there is a predicate on antiseden that is true, then the consequent also considered predicate true. In contrast to the statistical rule on the exact sciences that require a high percentage value (approaching 100%), the percentage value in DM usually around 50% support is considered high.

2.5. Distributed Component

Distributed component is a software component that is stored on a separate machine to the client application and facilitated by communication protocols are added into the basic components. By separating the components of the client application is expected to facilitate the developer in making changes to the features and implementation of the component at a later date, without having to recompile existing applications on the client. The components are typically managed by a distributed Kakas which serves to manage and monitor the activities of the components. Kakas example of this is the Microsoft Transaction Server.

2.6. Distributed Applications

Application architecture is a conceptual view of the structure of an application. In general, an application consists of a program code for processing the data, business logic and user interface. In the use of traditional enterprise application development paradigm that is monolithic, meaning that database, business logic and user interface incorporated into the same application. As a result, when there is a change, the entire system needs to be rebuilt, while the changes made are not too much. Another disadvantage, reusability of modules is very low. [STA00]

2.7. XML

Extensible Markup Language (XML) provides a way to describe data structures. Unlike HTML label that serves to control the display and the data displayed, the label on the XML used to define the structure and data types of the data itself. [W3C-2007]. XML uses a set of labels to describe the data elements. Each element of a piece of data, whether the data is simple or very complex. With the possibility to define a set of labels is not limited to XML.

2.8. SOAP

SOAP (Simple Object Access Protocol) is a simple class with basic XML protocol for exchanging information structure and types in the web [W3C-2007]. SOAP overall design goal is to make the exchange process to be as simple as possible and provide a minimum usability. This protocol defines an order book that contains no application or transport semantics. As a result, the protocol is modular high class and very knowledgeable. For example, the Web Service is to facilitate universal access to development services with SOAP.

2.9. Web Service

A Web Service is a programmable entity that provides special functions and elements of it can be accessed for several separate systems through Internet standards, such as XML and HTTP [RUS-2002]. Web services rely heavily on widespread acclaim XML and other Internet standards to create an infrastructure that supports interoperability of applications. A Web Service can be used internally within an application or open externally through the Internet to be used by many applications. Because Web Service can be accessed through a standard display interface, a Web Service allows different systems to work together as a single web.

2.3. Infrastructure Web Service

Web Service uses an infrastructure that provides the following services:

1. Discovery mechanism to locate a Web Service
2. A description of the service to mendefinisian how to use the service.
3. Standard format with a wire communication which.

2.4. Web Service Description

Web Service infrastructure found in communication via XML-based messages. Service description is an XML document that is written by an XML grammar, called WSDL (Web Service Description Language), which defines the message format that is understandable by the Web Service. Description of the service behavior of a Web Service and how the client instructions that can potentially interact with [MIC06b].

2.5. CORBA

Interoperability is the ability of mutual cooperation between computer systems. Interoperability is actually not new, because any data communication protocols (TCP / IP for example) are basically created to achieve interoperability. Which is not widely known is interoperability at the application software level. In the context of distributed computer systems, although the application components created with different programming languages, using different development tools, and operates in diverse environments, they still should be able to cooperate with each other. Interoperability of software requires certain homogeneity on a level. It required a kind of 'standardization'. Starting from this need was born the CORBA (Common Object Request Broker Architecture). CORBA is the result of 'agreement' between a number of software vendors and developers known as IBM, Hewlett-Packard, and DEC, who joined in a consortium called the OMG (Object Management Group). CORBA is a software architecture based on object-oriented technology or Object Oriented (OO) with the client-server paradigm. In OO terminology, an object communicates with other objects by sending messages (message passing). Communication context is then mapped into the client-server model: one object acts as a client (the sender) and the other acting as a server (which receives the message and process the message in question). For example, in the illustration at the beginning of this paper, if the patient requires a particular drug, then the application object in a doctor's office acts as a client and sends a message to the application object in the pharmacy to find out if drugs are needed are available there. The uniqueness of CORBA is its ability to handle heterogeneity between client and server (in CORBA terminology, a server object is called an object implementation (object implementation). Both can be implemented in hardware, operating systems, programming languages, and in different locations, but it can be mutually communicate. keys are on a layer of software called the ORB (Object Request Broker). CORBA architecture and ORBnya shown in figure 1 Lukito Edi Nugroho Unlike in the usual OO languages (C + + or Java), the process of sending a message from a client to an object implementation is not done directly. First, the stub and skeleton "isolate" the client and the object implementation of a low-level tasks such as marshalling and unmarshalling process data. Further ORB serves as a "broker" who bridge the heterogeneity between the two objects. ORB handles platform differences, tracking the location of the object, and the transfer of messages in such a way that is transparent to both the object. Thus the client programming and object implementations can concentrate fully on both functionality aspect. Mechanism shown in Figure 1 is the basic operation of CORBA-based systems. For example, in the case of the A above, the program at the doctor's office to act as a client for the program at the hospital. If Person A needs to be hospitalized, then the program will send a message to the doctor in the hospital program through ORB. Interestingly, both programs can be developed without the need for a lot of ties between the two, for example using a programming language, what operating system, and so on. Leaving enough of a 'deal' as outlined in an interface (see section on CORBA-Based Programming), the two programs can be developed independently.

2.6. CORBA-Based Programming

How can two objects are developed separately, with different tools and languages, as well as run on different computers can communicate with each other? What can "reconcile" the differences? The key is the concept of interface. In the OO technology, interfaces can be regarded as "a contract" between the two objects will communicate. For server objects, interfaces serve as "advertisements" about what he could do. For the client, the interface serves to determine what services are provided by the server. In CORBA, interface specification is the first thing to do, just like in real life where before the transaction, made first contract. Interface specification is made using a special language that is standard called Interface Definition Language (IDL). IDL own syntax similar to C++ language syntax. The most noticeable difference is there is no code for the function and checkTersedia checkHarga! Keep in mind that the interface is only stating what is available (what aspects), not to mention how to provide it (how aspect). We will not discuss the syntax of IDL in this opportunity. Our focus is how to use the interface specification created with the IDL to make the client and the object implementation in applications. IDL interfaces are written with just a framework for client programs and object implementations. Programmers still have to fill in the details of both of them so as to form a complete program. In the example above interfacecheckObat example, the functions should be implemented checkHarga and checkTersedia. That need to be considered in the programming and implementation of the client object is a programming language used. Language that can be used is that a mapping (mapping) with IDL. The mention of equivalence mapping data types, functions, and other programming constructs in the IDL programming language construction is concerned. In general, the popular programming languages such as C, C++, Java, Smalltalk, and COBOL has had this mapping. As already explained above, the client and the object implementation can use different programming languages. Next step is to compile the program. Client program, the implementation of the object, and interface specifications compiled. Interface specification compiled with IDL compiler, generate code stubs (for client) and skeleton (for the implementation of the object). Each supported language has its own IDL compiler. Linking process is then performed to produce a program that can be executed. This process is shown in Figure 2 below. So far we can see that the IDL solve the problem of heterogeneity and distribution of the location of

the object. There are still things that remain unresolved: how a client can access an object implementation? Normally in programming languages this is done through the name (identifier) the object. But what if the object implementation is located on a different computer and made with different languages? Using the CORBA object reference for this purpose. Each object has a reference implementation as a handle to access the object itself. Reference object is created by the ORB at the time the object is created, it is unique, and remains valid as long as the object exists. Object reference also hides the physical location of the object in question. With reference to the object, the client can access an object implementations without having to know where the exact location of the object. Object reference can be passed to other applications, are stored in a database, or given to a customer for use in the program.

2.7. ORB Interoperability

The scope of the CORBA-based computing is not just limited to the ORB only. Between the ORB with another ORB can also communicate. This model is very useful for large-scale enterprise computing with a very broad scope of distribution. In such a situation, it is impossible to use only one ORB for any existing program. The logical approach is to perform clustering, and a cluster is handled by an ORB. With this mechanism, each ORB required to be able to communicate with other ORB, to facilitate communication between programs running on it. Interoperability can be done efficiently and simpler by requiring two ORB to "talk" with the same protocol. Interoperable Internet Protocol (IIOP) is a standard protocol that must be owned by the ORB to be called "aligned with CORBA" (CORBA-compliant). In other words, IIOP is "a standard communication language" to the ORB. Interoperability can also be achieved through bridging (bridging). Allows bridging the communication is done by ORB with different protocols. This method provides flexibility to the implementor if the first method is not possible or difficult to apply, for example for reasons of computational solution demands the most cost-effective. Disadvantages, the overall system architecture becomes more complex because it requires inter-ORB bridges. At first glance this model looks complicated, but in terms of application had no effect at all. Maintained full transparency, the client does not need to know anything if the implementation of the ORB object is located in the same scope or not. If not, it will automatically throw ORBnya message to ORB implementations in which the object is located. In our case, if the demand of a drug can not be filled by pharmacies objects X, then the ORB in that place can forward this request message to the ORB in pharmacies Y for example.

2.8. OMA

So far, we only talk about interoperability at the object level. In fact, interoperability at the application level is much more complex. The linkage between one program to another so diverse, it is difficult for the provision of more comprehensive support is structured. With technology-based CORBA, OMG trying to pour his vision of distributed applications in an architecture called the Object Management Architecture (OMA). OMA classify the types of interaction between programs to facilitate the provision of support. Figure 3 illustrates the concept of OMA OMA application structuring the world into two large groups: service category CORBA (CORBA services) and facilities category CORBA (CORBA facilities). CORBA services provide basic functions used by almost every object in a variety of applications. These functions are usually quite generic and does not depend on the type of application domain. An example is the naming service (naming service). Imagine if we need a service but do not know where to look for servers that provide such services. Naming service can help us like a "yellow pages" (yellow pages), he can broadcast services directory listed him. Because it is generic, naming services can be used by applications from various domains. CORBA higher level facility. It provides services at the application level. There are two types of facilities: horizontal, which is required by the various types of domains (eg, user-interface), and vertical, that are specific to a particular domain (for example, in our case, the domain of health). Horizontal facilities function similar to CORBA services, but operates at a higher level because it is directly related to the functional aspects of the application. OMG continuously standardized the interfaces for the components in each category. The more services and facilities are standardized, the easier it is to achieve a component-based distributed computing in different areas of the plug-and-play, without being distracted by the heterogeneity problem.

2.9. Security Systems

When a person receives or sends messages on the network, there are 4 very important issue, that is confidentiality, authentication, integrity and non-repudiation. Secrecy is that our data can not be read by unauthorized persons. Authentication guarantee of the authenticity of the data and with whom we are dealing. Guarantee the integrity of that data is not changed during the journey, in other words, the data sent is received data. And non-repudiation, which means the sender can not deny that the message sent not his. One of the parts is a cryptographic one-way hash function. One-way hash functions is that we can easily perform the encryption cipher to get it but it is very difficult to get the plaintext. One hash function is the most widely used Message Digest 5 (MD-5). MD-5 is a one-way hash function created by Ron Rivest. MD-5 is one of the applications that are used to determine that the message is sent when no change is in the network. MD-5 algorithms in general is taking a variable length messages have changed to 'fingerprint' or 'the essence of the message of having a fixed length is 128 bits. 'Fingerprints' This can not be reversed to get the message, in other words no one can see the message of 'fingerprints' MD-5. Message digest or the essence of the message should have three important properties, that is:

1. When P is known, then the MD (P) can be easily calculated.
2. When the MD (P) is known, then it is not possible to calculate P.
3. No one can give two messages having the same essence of the message.

2.10. Library Studies

Maria Skouroliakou et al (2008). The use of computerized hospital records could potentially reduce medical errors and improve the cost-effectiveness of care by revealing the relationship between severity of illness and resource consumption in the ICU setting. The importance of computerized data management to improve safety and efficacy in the ICU for premature neonates has been fully

realized over the past few decades. Electronic documentation of some procedures for neonates. Establishment of a monitoring system allows for the study results as well as for the management of statistical information calculated yearly results have proven to be very important for the future and protect neonates to optimize the function of the ICU. Availability of this information allows clinicians to minimize errors and re-evaluate current clinical practice.

Sorin Gudea (2005). To minimize pretext, information systems use databases to store metadata transform data into information. Large organizations often store the same data in different systems. A company has different health facilities and systems used for processing of patient data. A patient can receive treatment at more than one physical facility affiliated with the same organization, sometimes with random events and sometimes as part of the medical management process. There is technology available to system integration practitioners. System integration solutions for the system involves the exchange of data between system participants. Electronic transmission of data between systems across organizational boundaries by relying on standards for information content, format and exchange mechanisms. With the advent of Internet standards, open data transmission and access such as HTTP, FTP, XML and SOAP begin to find a way into the world of middleware. Web services middleware technology complements other than completely replacing it.

Amany (2011). Communication and documentation is a means for the exchange of data and information. IS can facilitate communication between and among nurses, physicians and other health team members and improve patient outcomes. In addition, the use of IS to ensure completeness of documentation of patient care, facilitating the evaluation of patient care outcomes and improve patient safety

Designing Network

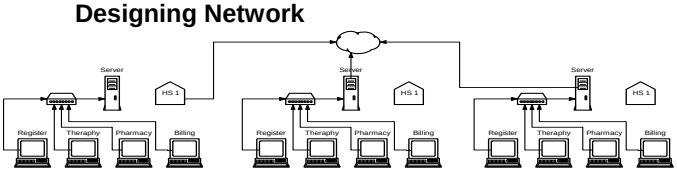

Figure 3.1. Network Model

Hospital networks in the design is a hospital has to serve an intranet network systems at hospitals concerned. Star topology is used for speed of access. The cable used is UTP cable connected to a switch hub centered. A live 24-hour servers used to store patient data. Interface used must be web-based for speed and ease of access. Server that is connected to the hospital that houses the Public Health Service hospitals in Indonesia.

3.2. Design Technology

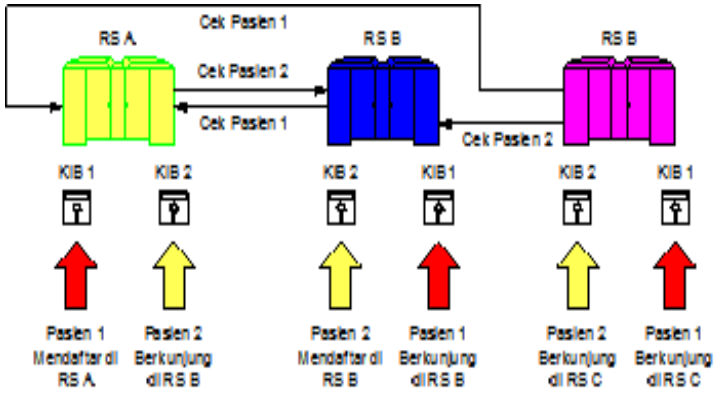

Figure 3.1. The problem frameworks

1. At the time of patient visit at Hospital A and sign up, then the database will be stored at Hospital A. Give KIB 1 patient in the form of print identity 1 Patient Medical Record Number and Identification Number Hospital A. After completion of the process in Hospital A, Patient 1 home and at that time, all activities are stored in database 1 Patient Hospital A.
2. At the time of patient visit at Hospital B and sign up, then the database will be stored at Hospital B. Give KIB 2 patients in the print form of identity Patients 2 and the Medical Record Number Identification Number Hospital B. After completion of the process at Hospital B, Patient 2 home and at that time, all activities are stored in database 2 Patient Hospital B.
3. One moment it is not possible, then the patient first visit to Hospital B. By showing his KIB Patient 1, the network connected systems will perform authorization at Hospital B. If the authorization is valid and accepted, the patient's identity will be displayed in the hospital with a complete patient history.
4. One moment it is not possible, then the patient 2 to the Hospital B. By showing his KIB Patient 2, the network connected systems will perform authorization at Hospital A. If the authorization is valid and accepted, the patient's identity will be displayed at the Hospital Bed complete with patient history.
5. One moment it is not possible, then Patient 1 and Patient 2 visited Hospital C. By showing KIB The patient, then the system is connected to the network will perform authorization at Hospital A and B. If the authorization is valid and accepted, the patient's identity will be displayed in the hospital with a complete patient history.

3.3. Design Technology

1. KIB made using Plastic Card Credit Card sandard size or ATM card.

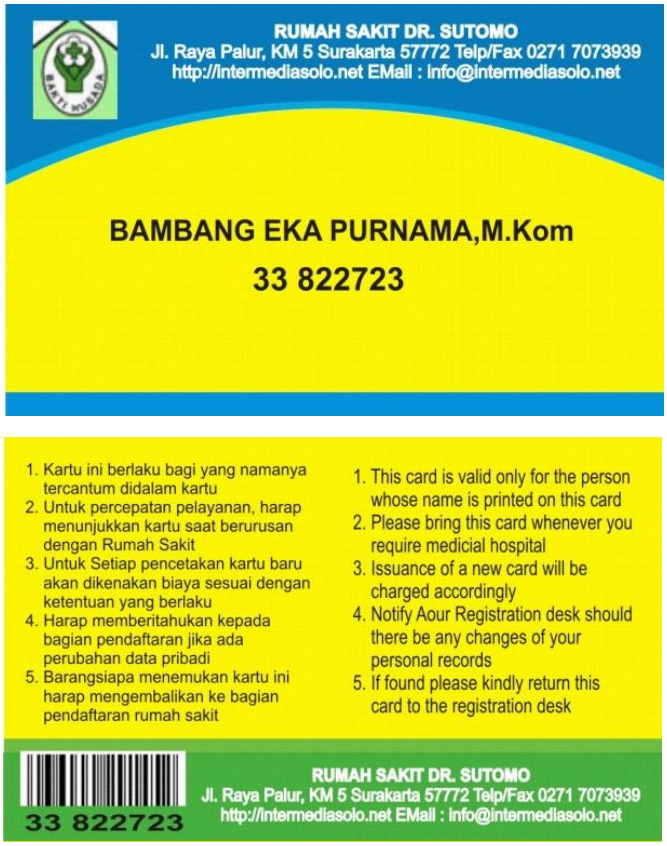

Figure 3.2. Medication Identification Card Design

4.1. Discussion

With the conventional system which had been a patient data will be stored in a conventional book. With this system, patient data will be difficult to be identified in the hospital, let alone in another hospital. With the proposed system in a patient who visit and register at a hospital will be digitally stored data. During a visit to another hospital and its patients submit KIB code system will track the hospitals where patients are listed first. To look at the track record of the patient, the patient can give authorization fingerprints would not be the same as other patients to the doctor to check. It's also a sign that the patient agrees history seen by a physician as further diagnostic reference.

5.1. Conclusion

1. With a well-designed system will be able to overcome the problem of data search quickly at a hospital.
2. Patients who visit any hospital will feel comfortable because it will not burdened with with paperwork.
3. Mall practice would be suppressed because the doctor can easily find previous patient history data, so as to determine the subsequent diagnosis becomes easier.

6. Bibliography

[1] Aghus Sofwan, Agung Budi P, Toni Susanto, *Aplikasi Kriptografi Dengan Algoritma Message Digest 5 (Md5),* Department of Electrical Engineering Faculty of Engineering, University of Diponegoro, Transmission, Vol. 11, No.. 1, June 2006

[2] Ismet Öztürk, Ibrahim Sogukpınar, *Analysis and Comparison of Image Encryption Algorithms,* Gebze Institute of Technology Computer Engineering Dept. 41400 Gebze /Kocaeli, 2005

[3] W. Puech, M. Chaumont and O. Strauss, *A Reversible Data Hiding Method for Encrypted Images,* SPIE-IS&T/ Vol. 6819 68191E-9, LIRMM Laboratory, UMR CNRS, University of Montpellier II, FRANCE, 2008

[4] Yusuf Kurniawan, Adang Suwandi Ahmad, M. Sukrisno Mardiyanto, Iping Supriana & Sarwono Sutikno, *Analisis Sandi Diferensial terhadap AES, DES dan AE1,* Proceeding. ITB Sains & Tek. Vol. 38 A, No. 1, 2006,

[5] Tedjo Darmanto / Yulison HC, Basis Data 2, Team D3 TKJ STMIK AMIKBANDUNG

[6] Madison L. Gates, PhD; and Phillip W. Roeder, PhD. *A Case Study of User Assessment of a Corrections Electronic Health Record,* Perspectives in Health Information Management *(Spring 2011): 1-20.*

[7] By Dean F Sittig, PhD; Brian L Hazlehurst, PhD; Ted Palen, MD, PhD; John Hsu, MD; Holly Jimison, PhD; Mark C

[8] Hornbrook, PhD, *A Clinical Information System Research Landscape,* The Permanente Journal, Spring 2002, Volume 6 No. 2

[9] *Gregory L. Alexander, PhD, RN,* A Descriptive Analysis of a Nursing Home Clinical Information System with Decision Support, Perspectives in Health Information Management 5; 12, Summer 2008

[10] Bambang Parmanto PhD, Matthew Scotch, and Sjarif Ahmad, A Framework for Designing a Healthcare Outcome Data Warehouse, the American Health Information Management Association, 2005

[11] *Mary E. Morton, PhD, rhia, dan Susan Wiedenbeck, PhD,* A Framework for Predicting EHR Adoption Attitudes: A Physician Survey, Health Information Management 6, 2009

[12] Chris Johnstone, MBChB, and Gerry McCartney, MBChB, A Patient Survey Assessing the Awareness and Acceptability of the Emergency Care Summary and its Consent Model, *Health Information Management* (Spring 2010)

[13] *Ronaldo Parente, PhD, Ned Kock, PhD, and John Sonsini,* An Analysis of the Implementation and Impact of Speech-Recognition Technology in the

Healthcare Sector*, Health Information Management 1;5, Summer 2004*

[14] Martin Pusic, MD, Dr J. Mark Ansermino, FFA, MMed, MSc, FRCPC, *Clinical decision support systems, BCMJ,* Vol. 46, No. 5, June 2004

[15] Robert J. Campbell, EdD, Consumer Informatics: Elderly Persons and the Internet, Health Information Management 2;2, Spring 2005

[16] Maria Skouroliakou, PhD; George Soloupis, MSc; Antonis Gounaris,MD; Antonia Charitou, MD; Petros Papasarantopoulos; Sophia L. Markantonis, PhD; Christina Golna, LLM, MSc; and Kyriakos Souliotis, PhD, Data Analysis of the Benefits of an Electronic Registry of Information in a Neonatal Intensive Care Unit in Greece Health Information Management 5; 10; Summer 2008

[17] *Sorin Gudea*, Data, Information, Knowledge: A Healthcare Enterprise Case Study, *Health Information Management 2;8, Fall 2005*

[18] Amany A. Abdrbo, BSN, MSN, PhD; Jaclene A. Zauszniewski, PhD, RN-BC, FAAN; Christine A. Hudak, RN, PhD, CPHIMS; and Mary K. Anthony, PhD, RN, CS, *Development and Testing of a Survey Instrument to Measure Benefits of a Nursing Information System*, Health Information Management *(Summer 2011): 1-15.*

[19] Sjamsuhidajat, *Manual Rekam Medis,* Konsil Kedokteran Indonesia, National Library Cataloging-in-Publication (KDT), Jakarta, 2006

[20] Brian hafiz adnan*, Sistem Pendaftaran, Rekam Medis dan Sistem Pembayaran Pasien Rumah Sakit Berbasis Teknolog Java Card*, Faculty of Engineering, University of Indonesia, Jakarta, 2008

[21] Arief Setyanto, *Mobile Medical Records,* STMIK AMIKOM Yogyakarta

[22] Raden Sanjoyo, *Aspek Hukum Rekam Medis,* FMIPA Universitas Gadjah Mada

[23] Abdul Mufti, Aplikasi Barcode 39 Pada Preregistrasi Online Penyelenggaraan Pameran, SNATI 2006 UII Yogyakarta

[24] Netty Rahayuningtyas, *Pembuatan Web Sistem Informasi Akademik Program Studi Diii Instrumentasi Dan Elektronika Berbasis Php Dan Mysql,* UNDIP Semarang, 2007

[25] Hatmoko Tri Arianto, *Pemprograman Aplikasi Platform Terbuka Berbasis Xml Web (Studi Kasus: Kolaborasi Aplikasi Dan Pertukaran Data Kependudukan Dengan Catatan Medis),* Faculty of Engineering, Diponegoro University

[26] Sharon Gondodiputro,dr.,MARS, *Rekam MedisDan Sistem Informasi Kesehatan Di Pelayanan Kesehatan Primer (Puskesmas),* Faculty of Medicine, Universitas Padjadjaran Bandung 2007

[27] Hosizah, *Electronic Health Record* (Ehr) Atau Rekam Kesehatan Elektronik: *Change In The Him Department,*

[28] Suhartanto, *Pembuatan Sistem Informasi Rekam Medis Di Rumah Sakit Umum Pku Muhammadiyah Bantul*

[29] Eko Handoyo, Agung Budi Prasetijo, Fuad Noor Syamhariyanto, *Aplikasi Sistem Informasi Rumah Sakit Berbasis Web Pada Sub-Sistem Farmasi Menggunakan Framework Prado,* Diponegoro University, Semarang, 2008

[30] Tantos, Sistem Informasi Rumah Sakit Ideal, FMIPA UGM

[31] Rr. Tutik Sri Haryati, SKp., MARS, Pendokumentasian Keperawatan Dengan Menggunakan Electronic Health Record (Ehr), UI Jakarta, 2010