Applying Zachman Framework in Designing Medical Recording System and Health Services for Chronic Patients

*Raden Aditya Bayu Pratama[1], **Bagus Afan Herlambang[2]**, **Gunawan Wang[3]**, **Nilo Legowo[4]**

[1,2,3]Information Systems Management Department, BINUS Graduate Program-Master of Information Systems Management, Bina Nusantara University, Jakarta, Indonesia.

E-mail: [1]rade.pratama001@binus.ac.id; [2]bagus.herlambang@binus.ac.id; [3]gwang@binus.edu, [4]nlegowo@binus.edu

Abstract

Enterprise architecture is a brief mission of stakeholders in which they have functional information, company information, and company performance parameters. Family Physician Hospital provides family-oriented community-oriented health services. Based on the above results, a system solution that fulfills information is needed, so that it will be able to answer research questions, including: 1) How to design a Medical Record System and Health Services for Chronic Patients using the Zachman method ?, and 2) How to map the design in the framework matrix Zachman? . The Zachman Framework is a 6x6 matrix that represents the intersection of two classification schemes - a two-dimensional system architecture. From these matrices each is described based on the abstraction seen from the perspective or perspective of the Planner and Owner. And use several UML Diagrams for describe piece of zachman framework column.

Keywords: Diagram, Zachman FrameWork, Enterprise Architecture.

1. Introduction

Enterprise architecture is a stakeholder mission which includes information, functionality / usability, organizational location and performance parameters. The main use of enterprise architecture is to inform, guide and limit decisions for organizations, especially in investing in information technology.

Dokter Keluarga are doctors who can provide community-oriented health services with a focus on the family, not only viewing suffering as a sick individual but as part of a family unit and not just waiting passively, but if necessary actively visiting sufferers or their families. Family doctor services are comprehensive medical services that focus services to the family as a unit, where the doctor's responsibility for health services is not limited by the age group or gender of the patient nor can organs or certain types of diseases [1].

One of the main tasks of the family doctor besides examining patients is also to provide information related to patient health. However, based on interviews conducted, obtained problems regarding managing information on the family doctor. Problems faced include: the patient forgets about the re-examination schedule, if the patient forgets the re-examination then the patient does not get the drug in that month, then the family doctor is difficult to promote health in the working area. Finally, the family doctor sometimes forgets the patient's schedule for having to double-check. From these problems we need a technology that can help reduce the problem of the family doctor.

Based on the above, a system solution is needed that can provide fast, accurate,

complete and integrated information about the overall medical record and health services. This case study analysis and design of the Medical Record System and Health Services for Chronic Patients uses the Zachman concept by focusing on the subutron of Planner, and Owner so that they can later answer the research questions below:

   a. How to design a Medical Record System and Health Service for Chronic Patients using the Zachman method?
   b. How to map the design in the Zachman framework matrix?

2. Literature Review

   A. Zachman Framework

Zachman Framework is the most widely known architecture framework. Enterprise data architects began accepting and using this framework since it was first introduced by John a Zachman in the IBM System Journal in 1987 and then developed in 1992 with the aim of providing a basic organizational structure that supports access, integration, interpretation, development, management, and changes in the architecture of organizational information systems (enterprise). [2].

The advantages of this framework compared to other frameworks are:

1. Zachman framework classifies enterprise system architecture requirements in great detail among other frameworks.

2. Zachman framework is a de-facto standard for classifying enterprise architecture artifacts.

3. Zachman framework describes in parallel both in terms of engineering and construction.

4. Zachman framework is widely known as a management tool for checking architectural completeness and maturity levels.

The Zachman Framework is a 6x6 matrix that represents the intersection of two classification schemes - a two-dimensional system architecture. In the first dimension, Zachman describes it as a line consisting of 6 perspectives namely [3]:

   a. The Planner Perspective (Scope Context): A list of the scope of explanation of business elements known by strategists as theorists.

   b. The Owner Perspective (Business Concept): A semantic model of business connectedness between business components defined by the chief executive as owner.

   c. The Designer Perspective (System Logic): A more detailed logic model that contains the needs and design boundaries of the system represented by architects as designers.

   d. The Builder Perspective (Technology Physics): A physical model that optimizes designs for specific needs within specific technological constraints, people, costs and timeframes specified by the engineer as the builder.

   e. The Implementer Perspective (Component Assemblies): Specific technology, about how components are assembled and operated, is configured by the technician as the implementor.

   f. THe Participant Perspective (Operation Classes): Events of real functioning systems that are used by technicians as participants.

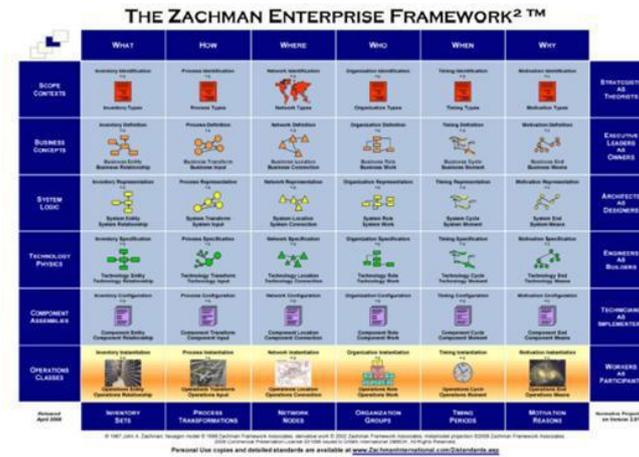   Figure 1 below is an overview of the Zachman Framework [2].

Figure 1. Framework Zachman [2]

3. Research Method

In this study the method used to analyze system design is to use the Zachman framework which will be described in each column consisting of What, How, Where, Who, When, and Why. In this study, it will be explained only from the point of view of Planner, Owner. For more details, the flow of research is presented in Figure 2.
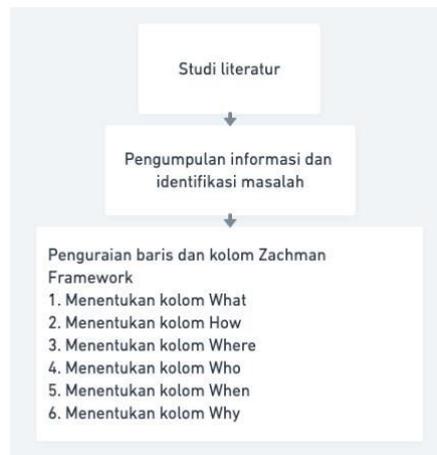

Figure 2. Reasearch Flow

4. Result and Discussion

Based on the results of data collection, the problem mapping process will then be carried out within the Zachman framework to produce the system designs needed. After the problem map is obtained then the next problem will be arranged in the Zachman matrix framework. After the Zachman matrix is obtained, each row and column in the matrix will be described one by one.

Following is the elaboration of Zachman's matrices from the results of the study:

    a. What column

    Explain data that can be presented from the perspective of Planner and Owner

    b. Column How

    The column discusses the processes that occur at the Family Physician Hospital

c. Where column
The column discusses the main business location where the information system is located and its infrastructure and configuration
d. Who column
The column discusses human resources that play an important role in the process of recording Medical Records and Health Services
e. When column
The column discusses the event or activity and its schedule. The main activities to be discussed are those related to health services
f. Why column
Describe the objectives, motivations and initiatives as well as the limits set relating to the information system that will be built.

Abstrak/Perspektif	Data What (Times)	FUNCTION How (Process)	NETWORK Where (Location)	PEOPLE Who (People)	TIME When (Time)	MOTIVATION Why (Motivation)
Planner/ Contextual (Scope)	Data komputer, SDM, Rumah sakit	Rekam Medis dan Pelayanan Kesehatan	Rumah sakit Dokter keluarga	Perawat, admin, dan Dokter	Input rekam medis rumah sakit keluarga dan pelayanan kesehatan	Visi dan misi rumah sakit keluarga
Owner/Conceptual (Business Model)	Flowmap dan Use case system	Perancangan data base dan activity diagram	Desain jaringan rumah sakit keluarga	Program mer, desainer, administrator, operator	Time schedule pembangunan proyek sistem informasi	Alasan pengadaan sistem informasi

Figure 3. Zachman Matrix of Medical Record Systems and Health Services

From the matrix above each is described based on the abstraction seen from the perspective or perspective of the Planner and Owner.

A. PERSPECTIVE PLANNER
The first line in the Zachman Framework is often called contextual architecture. This architecture defines a functional global business model and various external organizational requirements. Describe the vision, mission, context, boundaries, and architecture of the system. Often referred to as a black box, because we can see the input and output, but can not see the details of the work. This line is often called the context line.

1. What
This column describes data or entities that are related to the medical record system and health services. From the results of the analysis, the data are grouped into 3 parts, namely:

a. Human resource data, which is data that uses this information system (admin, nurse, doctor)

b. Family hospital data, namely data on family hospitals used as research objects.

c. Computer data, namely data about computers that are used as research objects.

In addition to the data above, there are several facts that also influence the development of the Medical Record System and Health Services, especially in the data architecture, including:

1. Source of data that is what data is needed to carry out medical records
2. How the flow of flow in conducting medical records
3. How does the family doctor's hospital provide services to patients

Although these facts greatly affect the data architecture, it is expected that the database used in the Medical Record System and Health Services can still be accessed easily and consistently. To achieve these conditions, a centralized data architecture approach is used. With this approach, we need an adequate data center or server to accommodate database needs.

2. How

This column discusses the processes that occur in family hospitals. The main process that occurs is the process of recording medical records and health services:

    a. The process of recording medical records

        1. The nurse or doctor identifies the process of recording medical records

        2. Conducting interviews to obtain data

    b. Health services

        1. Survey patients and conduct interviews with patients

        2. Conduct interviews with nurses and doctors

        3. Record data search results to stakeholders

3. Where

This column discusses the main business location, the location where the family doctor's hospital is located in Sleman, Yogyakarta

4. Who

This column discusses human resources that play an important role in the process of medical records and health services in family doctor hospitals. The following are people who played an important role in the process:

    a. Patient

    b. Nurse

    c. Doctor

5. When

This column is explained about the activities that occur at the family doctor's hospital. The main activities to be discussed are those related to the medical record and health service processes. The activities are:

    a. Medical records are recorded on the form that is available

    b. Forms are collected and checked by nurses

    c. Nurses and doctors examine patients

    d. Nurses and doctors provide health information services to patients

    e. Nurses and doctors provide information services to patients individually and as a whole for health information

6. Why

In this column explained about the vision and mission in general at the family doctor's hospital.

    a. Vision

    "Becoming the Family's Choice Hospital in Yogyakarta with the spirit of healthy living"

    b. Mission

    1. Provide excellent, family friendly and patient-oriented health services

    2. Providing quality services

B.   PERSPECTIVE OWNER

In this perspective zachman columns will be explained from the perspective of the owner or the person most responsible for the Medical Record System and Health Services is the Head of the family hospital. From this point of view the owner will present a proposed system and how the system can be used in a still simple picture. The owner only sees how the system will work, who are the people needed to build the system and what the purpose of the system is.

1. What

This section explains how the entities that have been determined from the Planner's perspective relate to carrying out processes in the Medical Record System and Health Services. In Figure 4 and Figure 5 use how the process occurs.
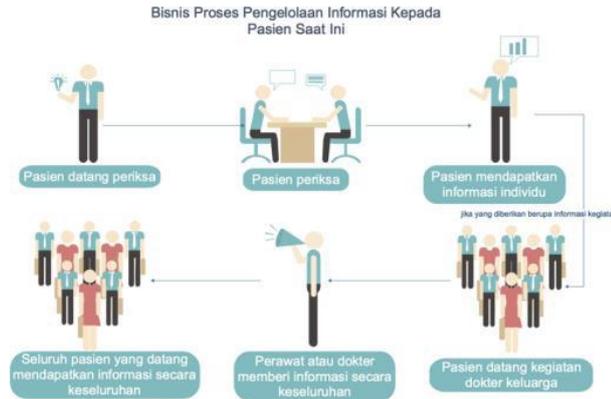

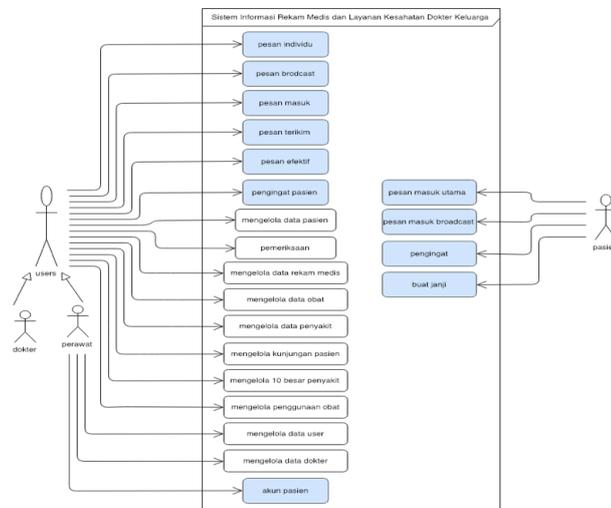**Figure 4 Medical Record Flowmap and Health Services**

Figure 5 Use Case Diagram

2. How

This column describes the process that occurs in the diagram created in the what column. The process is:

 a. Provide information to patients individually Figure 6
 b. Providing information to the patient as a whole Figure 7
 c. Recording patient data Figure 8
 d. Recording added patient data figure 9

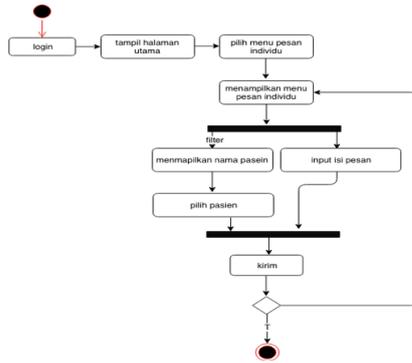The following is an overview of the processes that occur in the Medical Record System and Health Services:
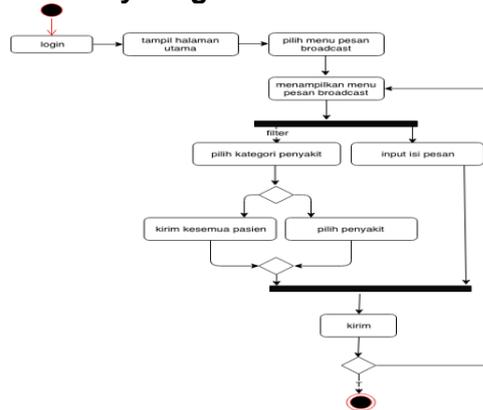
Figure 6 Activity Diagram of Individual Messages

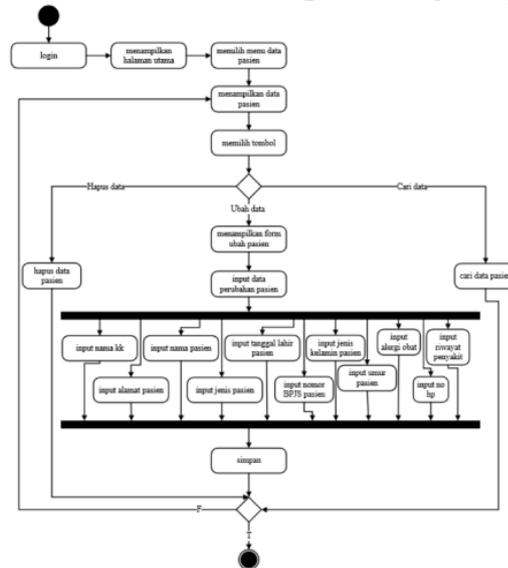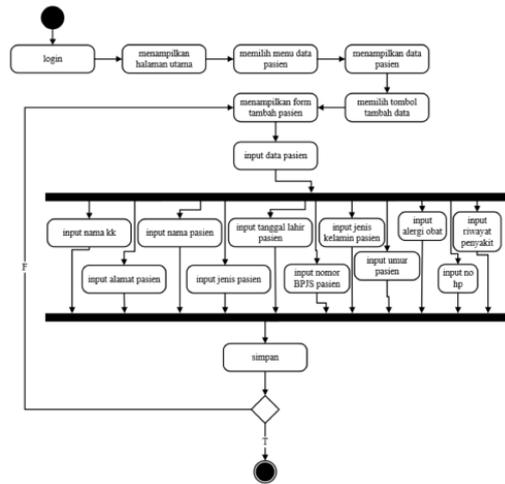
Figure 7 Broadcast Message Activity Diagram

**Figure 8 Activity Diagram of Patient Data**

Figure 9 Activity Diagram Add Patient Data

From the above process, it can already be seen what each entity does. Therefore each entity will be given the necessary limitations in using this system.

3. Where

This section will explain where the information system will be located. The Medical Record and Health Service System will be located in the local network of the family doctor's hospital to facilitate the recording of medical records.

Map of the existing network in the family hospital section can be seen in Figure 10. In Figure 10 can be seen that this family hospital section has two sub networks where all are connected together through a Router.
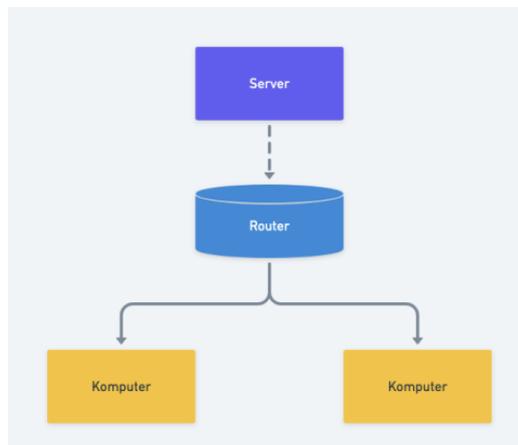
Figure 10. Map of the existing network

4. Who

This section explains who the human resources will be assigned by the owner to develop and manage the information system.

These personnel include:

    a. Computer manager
    b. Web designer
    c. Web programmer
    d. Person in charge of Information Systems

5. When

In this section explained the schedule or time schedule to build a Medical Record System and Health Services at the family doctor's hospital which will be determined by the owner then will inform the team who will carry out the project. Table 2 below is the compiled time schedule.

No	Rencana Kegiatan	Target Output	September				Oktober				November				Desember			
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1	Persiapan Proyek	- Pendefinisian masalah	█															
		- Penetapan Jadwal Proyek	█															
2	Fase Analisis dan penerapan kedalam framework Zachman	- Pengambilan data		█														
		- Menentukan kebutuhan sistem			█													
		- Membuat prototype permasalahn dengan matrik Zachman dengan penentuan kolom What, How, Where, Who, When, Why dengan penyelesaian masalahnya					█	█	█	█	█							
3	Implementasi	- Mendapatkan prototype aplikasi										█	█	█	█	█	█	█

Figure 11. Time Schedule Project Plan

6. Why

In this column, it is explained about the objectives to be achieved by the family doctor's hospital section related to the existence of information systems. The objectives are:

    a. Want to make better management in recording medical records and health services

    b. Make time effective for recording medical records and health services

    c. Want to make a safe record in a system

    d. Want to provide more optimal health services with this information system.

5. Conclusion

From the results of data collection and analysis and interpretation of the writings earlier, it can be concluded as follows:

1) The framework Zachman able to see each component 's Hospital from various perspectives: firstly Scope (Contextual), the viewpoint of the initiators, Second Business Model (Conceptual), the owner's point of view (Owner's view) . Last is the System Model (Logical), the developer's point of view .

2) With the Zachman framework that is used, a holistic details, and integrated perspective for the Architecture of the Medical Record System and Health Services is created.

3) The depiction of each cell in the Zachman framework, using UML diagrams, such as use charts, activity diagrams, and. flowmap diagram as a depiction of the Hospital's business, which illustrates the parallel nature of both engineering and construction.

6. SUGGESTIONS

Below will be presented a number of suggestions relating to future research related to the Medical Record System and Family Physician Hospital Health Services . The suggestions include:

1) In order to be a complete design in accordance with the Zachman framework, it is recommended to describe each cell in the framework completely.

2) To be able to find out the cost of developing a system it is necessary to research

the costs and benefits of developing a Medical Record System and Health Services for Family Physicians Hospital.

References

[1] A. E. Prasetyawati, "Dokter Keluarga Dan Wawasannya," Universitas Sebelas Maret, 1992.

[2] J. A. Zachman, "The Concise Definition Of The Zachman Framework By: John A. Zachman," 2008.

[3] A. Radwan And M. Aarabi, "Study Of Implementing Zachman Framework For Modeling Information Systems For Manufacturing Enterprises Aggregate Planning Radwan , A ., And Majid Aarabi," In Proceedings Of The 2011 International Conference On Industrial Engineering And Operations Management, 2011, Pp. 9–14.

[4] S. Dharwiyanti and R. S. Wahono, "Pengantar Unified Modeling LAnguage (UML)," IlmuKomputer.com, 2003.

[5] R. Heath and W. T. Coombs, "Gantt Chart," in Encyclopedia of Public Relations, 2014.

[6] I. P. Wardani, "Aplikasi Pengingat Jadwal Periksa Medis Berbasis Short Message Service (Sms) di Klinik Desa Jurang Temanggung," Stmik El Rahma, 2016.