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Relational Database for Health Care

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Abstract: The development of activities within a company will increase the complexity of business processes with transactional data that will increase from time to time. This is also experienced in health services, which are health service institutions for the community and certainly involve a lot of data in their operations. Starting from the registration process, medical/paramedical examinations, hospitalization, purchasing drugs, laboratories, etc. These data certainly require a container that can be used to manage the data needed in the transaction. So that later these data can be easily integrated and processed into a useful output. Database as one of the media that can be used to accommodate all supporting data. By using a database, and the features of a Database Management System (DBMS) can help companies carry out their operations more effectively and efficiently. The research method used refers to the analysis and design. In the method of analysis, literature studies are carried out from various supporting sources and observations of samples of research objects. While the design method refers to database design using the Database Lifecycle approach.

Keywords: Database; Health Care; Relational

Introduction

In the current Millennial era, the use of information technology is increasing all the time, so the role of information systems is needed to support business processes in an institution, both in government and private (Fenech et al., 2019; He et al., 2021). If you look at the basic definition of a business process, it refers to a logically related set of tasks and behaviors that an organization develops over time to produce specific business results and the unique way in which these activities are organized and coordinated (Pressman, 2010). Where in the process involves input and output, and can be measured, both in terms of user satisfaction, cost usage, time served, quality, differentiation, and productivity. Business processes within a company can become a competitive advantage if the company can continue to innovate or in practice its operations can be superior to existing competitor companies (Shah, 2022). This condition applies to all types of companies or institutions. In this research conducted at health service institutions, as a social institution that focuses on providing health services to the community, and will involve important data to support their daily activities (Lee & Lee, 2021). The data are of course not only as evidence of operational implementation, but also as material for future analysis (Aapro et al., 2020). Therefore, in practice, it requires special media as a container to integrate and manage the company's supporting data. One of the supporting media that can collaborate on data, so that the data can later be used optimally, is implementing a database (Ghazal & Alzoubi, 2021).

A database is a collection of logically related data and data descriptions designed to meet the information needs of an organization (Coronel & Morris, 2022; Mannino et al., 2021). The use of a database in a company is usually not only used by one department, but with a very large capacity the database can be used simultaneously by various departments and interested users within the company.

The use of the database will, of course, involve the Database Management System (DBMS) in its operation (Rawat et al., 2021; Thanuja et al., 2022). DBMS is a

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software system that allows users to define, create, organize, and control access to databases (Coronel & Morris, 2022). In particular, the DBMS provides several facility functions, such as:

Data Definition Language (DDL)

This language classification allows users to specify data types, structures, and constraints on data stored in databases. Where by defining the DDL command will help in the establishment / change the structure in the database component that is formed (Chen, 2023).

Data Manipulation Language (DML)

This language is used to enter, modify, delete, and display data from the database (Setiyadi, 2021). So that users can easily make changes to the data stored in the table (Ghali & Abu-Naser, 2019).

Access Control

This function provides several access controls, such as security system, which is used to prevent unauthorized users from accessing the database; system integrity (Duggineni, 2023), which maintains the consistency of the data stored; concurrency control system, which allows access to data in the database automatically shared; recovery control system, which restores the database to its initial state if an error occurs hardware/software; and user-accessible catalog, which contains a description of the data in the database (Boumezbeur et al., 2022).

In its operation, a DBMS consists of five main components, including hardware, software, data, procedures, and brain-ware (Budayawan et al., 2023). Where each of these components are interconnected in supporting the operational database that runs. So that the functionality of the database can be used optimally. Hardware and software are used as infrastructure in implementing the database. Where hardware and software specifications must of course be able to meet the standardization of database needs. In addition, there is data that is used as an object in database storage. From the human side, it is divided into procedures and people. Procedure refers to the instructions or rules that govern the design and use of databases. And humans are as subjects who control the running system.

Method

Method of Analysis

The analysis process has several stages: (1) Observation of the running system. This method is carried out by observing ongoing work procedures, as well as studying the literature from several (Enders & Hoßbach, 2019; VanDerHorn & Mahadevan, 2021). (2) Perform an analysis of the results of observations that have been made. (3) Identification of information needs from the results of observations is then realized in the analysis documentation stage, such as creating a system flow using the Unified Modeling Language (UML) notation. (4) Identification of system requirements that are collaborated using the VB.Net programming language and database using SQL DBMS. Where the results of the analysis are expected to form a system that can process quickly in terms of entering each data and also in searching for data that has been stored in the database.

Design Method

There are several stages based on information from the results of the analysis process on the problems and the system that is running. Database design is carried out using the database system development life cycle approach (Foster & Godbole, 2022), which is divided into several processes: database planning, system definition, requirements gathering and analysis, database design, DBMS selection (Roy-Hubara et al., 2019), application design, prototyping, implementation, data conversion and loading, testing, and maintenance operations (Ramis Ferrer et al., 2021).

Result and Discussion

Integrating business processes by using information technology in it has a pretty good influence on performance improvement that occurs within an institution. This fact has influenced the mindset of business people in general, where the current orientation is not only focused on increasing profit taking. Also start thinking, how to improve operational performance, so that its implementation makes a good contribution to the functions involved in the company. This is the background, why currently many companies are starting to be concerned about the use of information systems in the implementation of all operations that occur. In fact, reengineering and reconstruction often occur within an institution to improve ongoing processes.

The role of the database as a data manager in a company's system is very significant, where the database does not only act as a data storage medium, but as a foundation in the formation of an information system (Peng-Ting et al., 2020). The design of a database must be able to meet all standard criteria as well as the needs of each part involved in the company. Therefore, a good design is needed in analyzing every process that occurs within the company, so that the database that is formed can later accommodate operational needs that run within the company.

Identical health services as an institution that contributes to the social sector have a considerable influence on society, where in its daily operations it involves and produces data in it, such as patient data, diseases, drugs, medical, para-media, examinations, etc. For an institution, data is an important component that can support the company in carrying out its operations. Through these data, companies can easily carry out their operations, and can obtain an objective picture of the conditions that occur within the company. So that with the information collected, the company can conduct a self-evaluation of ongoing operations and find out what influences the company, so that it can be even better in the future. Even though health services are not fully oriented towards profits, in carrying out its activities it requires optimization of all parts so that the services provided can be more optimal.

In this study, referring to the operation of health services in general. Starting from registering new patients, conducting outpatient examinations, inpatient care, the ER (Emergency Unit), as well as recording the examination of patients receiving treatment and a description of the patient's health condition. This is also emphasized (Delimayanti, 2007), the form of health services provided by the health service unit, consists of a physical examination and anamnesis of the patient whose results are documented in the patient's medical record book. The medical staff will make a diagnosis based on this data and write down the right therapy and make a prescription for the pharmacy department to prepare. The patient's medical record book will be useful as a list of the patient's medical history and is used for recording and storing patient examination data in all health services, so that developments that occur in the patient can be known. The stored data, the end of the process will be processed into reports needed by managerial or from related parts. Where the report will be used for further analysis (Berdik et al., 2021), so that the hospital can find out and analyze the performance of the services that have been carried out, in order to determine the follow-up in achieving the expected goals.

Problems that often occur in operational systems that are still running on a file basis without the involvement of applications and databases in them (Logeshwaran et al., 2023), include: (1) The difficulty in finding the supporting data needed during transactions that occur. This has an impact on decreasing the level of performance of the services provided. (2) The process of documenting each supporting data becomes inefficient, because if you still use a manual system, of course the institution will experience difficulties in backing up all important data. (3) Data integration between sections will be hampered, because there is no system that combines data from each unit/division. So if the managerial party needs important data to monitor or analyze the running process, it will take a long time to prepare the data. (4) Data redundancy often occurs, where the data stored by each division experiences repetition. This results in operational inefficiencies, such as during maintenance or in terms of disk usage.

From the problems that occur, of course, have an impact on institutional performance. By looking at these problems, the implementation of databases and information systems within a company can be a solution for companies to overcome all problems related to organizing data (Kalra et al., 2020).

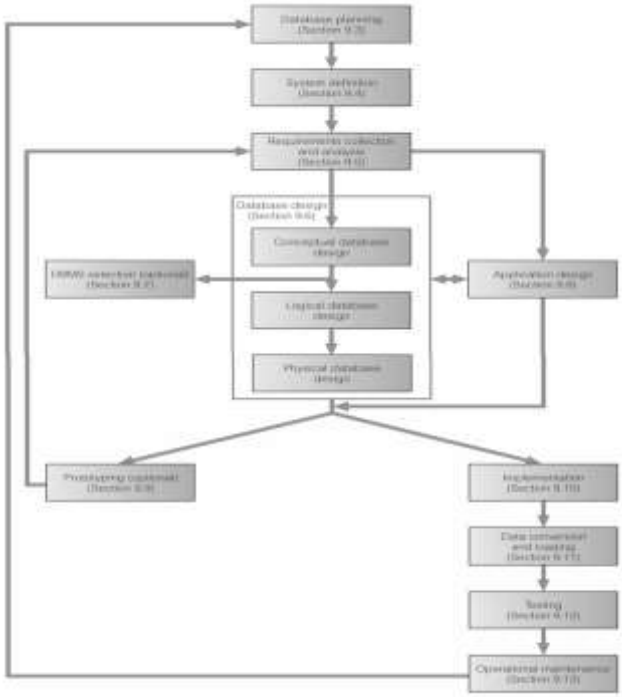

Figure 1. Life Cycle Database

The database design process is carried out through several stages that must be passed in Figure 2 above. Where the process follows the database lifecycle approach by Connolly & Begg (Connolly & Begg, 2005). The database design process is divided into three main stages, which consist of.

Conceptual database design

The first step at this stage is to build a conceptual data model needed in the company, which involves: entities, relationships, attributes, domains, primary keys, and integrity constraints. Conceptual data models, usually obtained from documentation, including entity diagrams and data dictionaries, are generated through the development of models obtained from analysis of data and business processes that have been going on so far in a company/organization. Stages in the conceptual, divided into several stages, including: Identifying

entities, this stage is carried out by identifying the objects involved in operations so far, which at this stage refers to the data used by the company so far, both from the internal and external sides of the company; Identify relationships. After all entities have been identified, the next step is to determine the associations/relationships that occur from each entity that is formed, whether each attribute in the entity requires data from other entities or whether one entity generates other entity derivatives; Identify and associate attributes with entities or relationships. The next step is to identify the attributes that make up the entity formed, the data types of the attributes, and the nature of the data that make up the attributes, whether they can be NULL or not and determine the Multi-value attribute, where the amount of data filled in may be more than one per field/attribute; Determine the attribute domain. This stage is used to determine the rules for storing data in the database. Where each attribute is given the rules of the data; Determine the candidate key, primary key, and alternate key attributes. The next step is to determine the candidate key attribute or what is known as the primary key candidate. Then from the candidate key that is formed, the next step is to determine the suitable primary key to identify the records in the table. Attributes that are not selected to be the primary key will be referred to as alternate keys.

Analyze the concept of enhanced modeling. This stage is used to analyze the conceptual data model, whether the modeling is from the associations formed, there are enhanced associations (mandatory and participation). Check redundancy in the data model. After all relations are formed, it is checked whether it is still possible to have redundancies in the formed data model. Data model conceptual validation with user transactions. This stage is used to validate the conceptual model of transactions from each user in the company.

Review the conceptual model data with users. After validation, the next step is to review the conceptual model with user needs, as well as requests submitted by the company. The results of the design carried out at the conceptual stage, produce a data model, as shown in Figure 2.

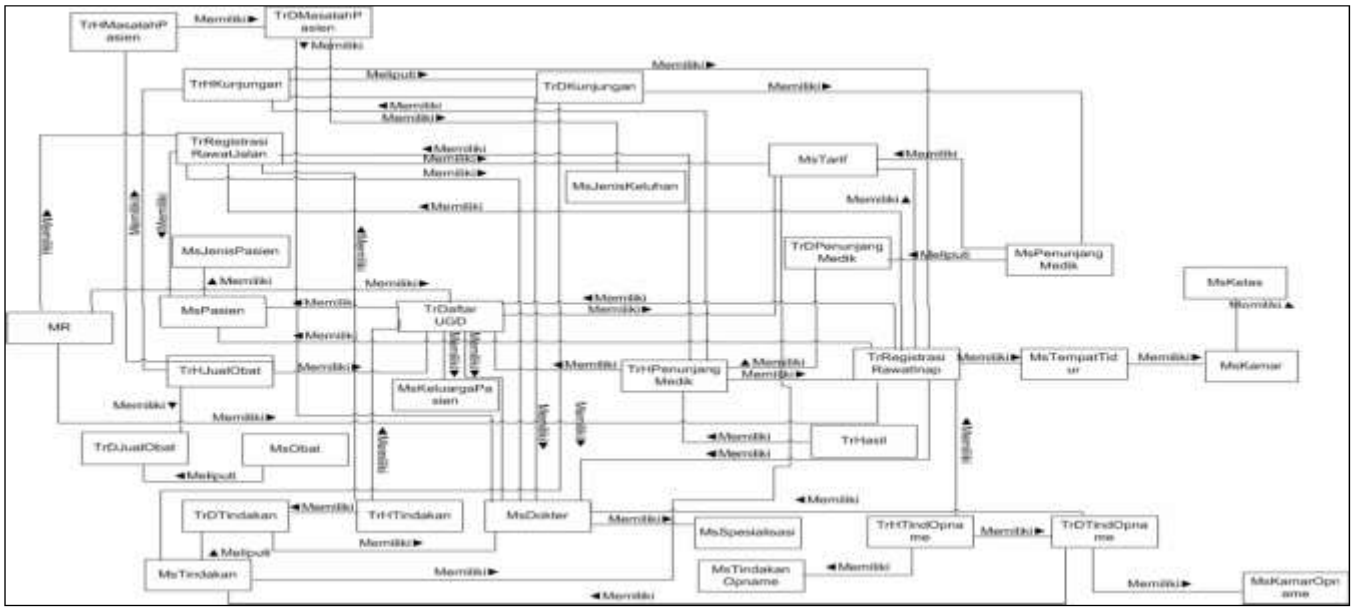

Figure 2. ERD Conceptual Model of Health Services

Logical database design

After compiling the conceptual model data, then the logical stage, this stage is validated and checked structurally, whether it is appropriate and supports the required transaction data. This stage, to change the conceptual data model that has been made into a logical data model in accordance with the requirements, this can be achieved by carrying out the following stages:

Create a table for the logical data model, to determine the type of entity and the type of relationship that is formed, such as: determination of strong – weak entity categories, one to many binary relationships, one to one binary relationship, superclass/subclass, many to many binary relationships. Validation of tables using normalization, validating each entity using the stages of normalization so that the stored data does not occur later on with anomalies or redundancies.

Normalization validation with user transactions. After going through the normalization stages, then checking the data model that is formed with transactions carried out by users, whether there are still entities that do not accommodate operational implementation, if

there are, additional entities are added according to transaction needs. Checking the integrity constraints, to check the constraints of each entity that is formed, whether it is in accordance with the data storage rules or constraints still need to be added.

Review the logical data model with the user, review the logical data model formed with the requirements that have been set at the beginning. Combining the logical data model into a global data model, is done to combine each logical data model that is formed per each part into one global data model as a whole. Checking future growth, predicting data increase, or attributes that affect the working system.

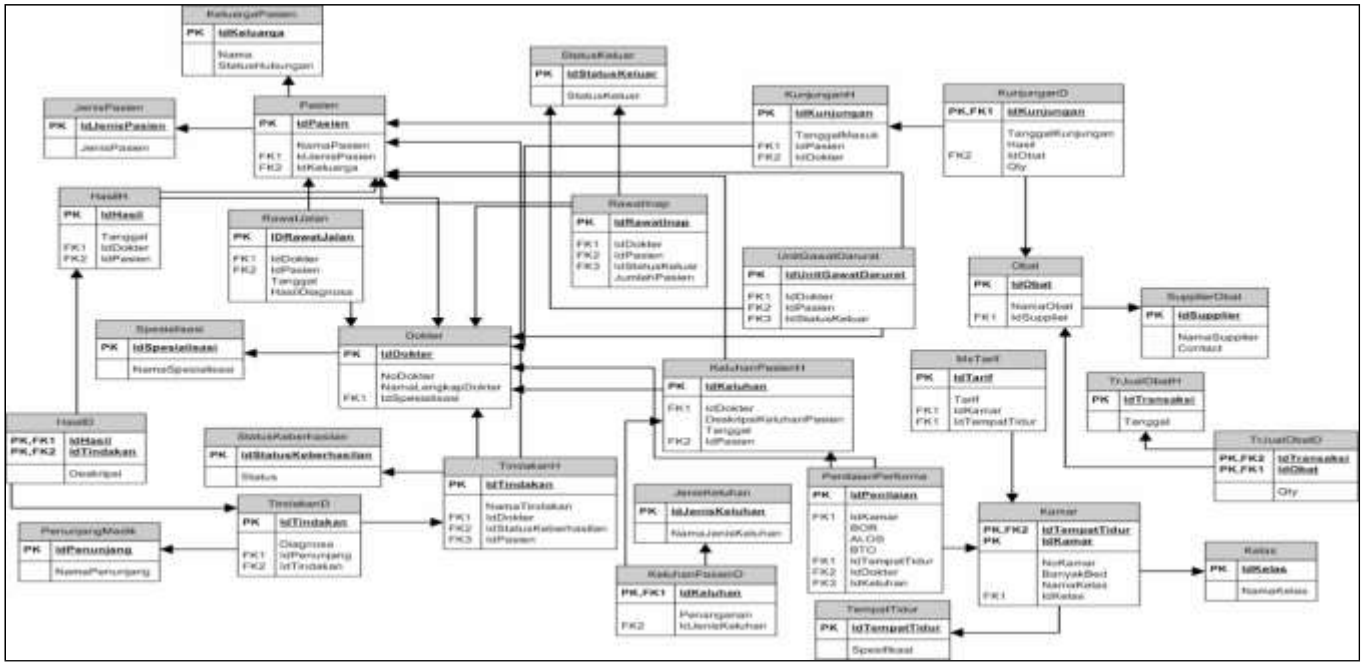

Figure 3. ERD Health Service Logical Model

Physical database design

The next stage is the physical stage, this stage describes the implementation of the database design to physical storage in the Database Management System (DBMS) as well as application design that describes existing transactions, implements tables that have been formed, determines files based on the DBMS used, uses indexes for attributes used in the application, application of defined attribute integrity constraints, and definition of a security system in the DBMS, so that the system formed cannot be infiltrated by irresponsible users (Rahutomo et al., 2022).

In detail, the stages in designing a physical database (Date, 2019), there are several stages: Changing the logical data model according to the DBMS, converting the formed logical data model into syntax in SQL language according to the DBMS standard used. Designing organizational files and indexes, designing organizational files, and indexes based on the attributes or fields that are formed.

Designing the user view, designing the user interface of the application for the external level for users to interact with the system. Design security mechanisms. After creating an application prototype and converting the data model into the DBMS, then determine the security mechanism of the system and the DBMS. Starting from determining users who have access rights, determining access control, and how the backup and recovery mechanism is carried out.

Redundancy control, to exercise control over stored data to prevent data repetition. Monitor and tune operational systems, carry out monitoring processes for operations that occur, and ensure the performance of the system and database to support ongoing operations. Following are the results of designing a physical model to be represented in the form of a user view.

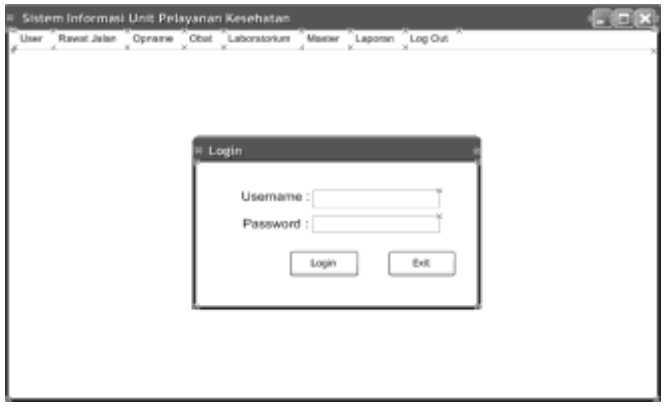

Figure 4. Screen Design

User view is used for users when they first access the system, where users must enter a username and password according to their access rights. Furthermore, the user can run the operational system in accordance with the job desk that is owned by the user. Transactions made by users are recorded in the transaction log, if there is damage to the system or the data can be tracked.

Conclusion

Data related to operations and supporting data will be properly recorded and stored in an integrated database. This can provide benefits for the company in terms of tracking the operational data that is carried out, if you want to know what factors are the advantages in competing with competitors can be done quickly and easily. The establishment of a health service application system, it can help integrate data generated from all activities carried out. Operations and services to the community can be carried out more effectively and efficiently. Implementation of system security makes data security more structured, unauthorized parties do not easily enter the system. The process of generating data can be done easily, because all data is stored in one container (database). Can be minimized in making reports needed by management to support decision making.

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The authors declare no conflict of interest.

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