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Design a Patient Medical Record Application to Shorten Registration Time Using the Waterfall Model

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ABSTRACT

Health agencies need speed of information services and provide optimal service to customers. The patient medical record procedures at the Rohil Medika Clinic, from patient registration to making daily reports, still use a manual system, so activities are ineffective and inefficient. The research aims to produce a design for a Web-Based Patient Medical Record Application at the Rohil Medika Clinic, which makes monthly patient visit report information and patient medical record report information that aligns with the needs of the Rohil Medika Clinic. The data collection method was obtained by observing and interviewing Rohil Medika Clinic Leaders and other medical workers. Data processing begins with evaluating the Clinic's needs and then designing the system design, interface, system coding (implementation), and conducting system testing. The research results based on trials show that the application can handle patient administration, patient examinations, and patient medical records and save time searching patient data by up to 67.6% to 90.9%. Medical record applications also increase clinical services from 25 patients to 45 patients/day to 45 patients to 95 patients/day. The system can also provide information on daily and monthly patient visit reports, medical records, and patient data reports.

Keywords: Medical Record Application, Waterfall, Clinic, Website.

INTRODUCTION

In human life today, computer science and technology development are growing [1]. The result of computer technology brings influence and rapid progress in various fields, including health agencies [2]. Health institutions need the speed of information services and optimal customer service [3]. The existence of information technology can help humans in processing data. It can help humans

provide information and the smooth process of recording medical records that still use a manual system [4] [5].

Health institutions that provide optimal service can provide patient satisfaction and trust for treatment [6]. With the improvement of the service system, it is expected to be able to fulfil the strategy to compete. System improvement can be realized through a medical record information system. Records Medical records contain records and documents about the patient's identity, examination, treatment, actions, and health services to patients. The patient's medical record data can be used as a reference for the patient's subsequent medical examination [7]. The medical record is processed, which will be helpful for the management to find the information [8].

Rohil Medika Clinic is a public clinic. The purpose of establishing Rohil Medika Clinic is to provide health services to the community in Rimba Melintang District and surrounding areas, both to general participants, BPJS Kesehatan and BPJS Ketenagakerjaan. In providing services, Rohil Medika Clinic operates every day. The patient medical record activities at the Pratama Rohil Medika clinic start from the patient's arrival at the administration department. If the patient is new, the administration will record patient data on the medical record registration form and then record the patient's identity on the visit book and patient card.

Furthermore, the patient card is given to patients who have registered. The registration process takes an average of 8.7 minutes/patient. The administration department will ask for a patient card if the patient is old. Then, the administration department looks for the patient's medical record paper according to the sequence number and patient identity, with an average time of 6.6 minutes/patient. Suppose the patient forgets to bring the patient card. In that case, the administration looks for patient data according to the patient's name in the patient data book and visit book with an average time of 8 minutes/patient and then searches for patient medical records with an average time of 6.8 minutes/patient. Then, the paper is given to a doctor or midwife for consultation. The doctor or midwife will state the complaint and diagnosis in the patient's medical record. Next, the patient chooses to be given medicine or action. If the patient decides the procedure, then the patient will be referred to the action room according to the doctor's diagnosis and carry out treatment. If you choose a drug, the doctor will submit a medical record paper containing the consultation results and illness information to the clinic officer. Next, the clinic staff took the medicine and gave it to the patient.

Furthermore, the administration will record the medical record paper to recap the overall data of patients who visited that day in the visiting book with an average time of 5.5 minutes/patient. The patient's medical record paper that has been recapped will be rearranged into the cabinet according to the patient's alphabet, with an average time of 5.2 minutes/patient. Patient Service Process and Patient Medical Record Data Search at Rohil Medika Clinic

The problem is that the medical record recording section, namely complaints, diagnoses, and drug prescriptions, still uses A4 paper as a recording medium, which can cause damaged medical record paper, loss of medical record data, and accumulation of medical record paper. By using A4 paper as a medium for patient medical records, the Clinic requires more storage space, causing the place in the administration to be narrow. Recording of patient medical record papers still uses a manual system, causing the delivery of health services to be hampered. Administration officers also find it challenging to search for patient medical record papers when patients want to consult again about the disease suffered. The administration must look for medical record data stacked in the closet. If the medical record data is lost, the administrative officer often registers the creation of a new number on behalf of the patient. So patients wait long to get health services, which causes long queues.

A web-based information system is needed to process medical record data at Rohil Medika Clinic. Web-based information systems are used to facilitate data access, data storage, data delivery, and information reception [9]. The data in the web-based application system will be stored in the database, so the data will be stored safely even if the computer error [10]. Web-based applications are lightweight and can be accessed quickly through a browser and an internet connection or intranet

[11] because users can access any data or information through laptops, smartphones, and even PCs in their homes quickly, in contrast to desktop applications where users have to install software or applications that are needed only to access data or information [12]. A web-based system must be designed gradually so the resulting web can be well organized [13]. The development model commonly used in system development is the waterfall model. This model approaches systematically and sequentially, starting from the level of system requirements and then going to the stages of analysis, design, coding, testing, and maintenance [14].

METHOD

Identify the Problem

The problem in the Clinic where the research is is that the recording of medical records, namely complaints, diagnoses, and drug prescriptions, still uses A4 paper as a recording medium. It can cause damaged medical record paper, loss of medical record data, and accumulation of medical record paper [15]. The Clinic also still uses a manual system, causing the provision of health services to be hampered and constrained in making monthly medical record reports [16].

Data collection techniques

In this study, the data collection techniques used were:

a. Observation

This Observation was carried out at Rohil Medika Clinic to observe the situation according to the topic to be studied [17].

b. Interview

In the interview process, researchers meet with information sources directly to ask questions [18]. The Interview was conducted at Rohil Medika Clinic for the medical records section. Figure 1 shows the Flow Chart of this study.

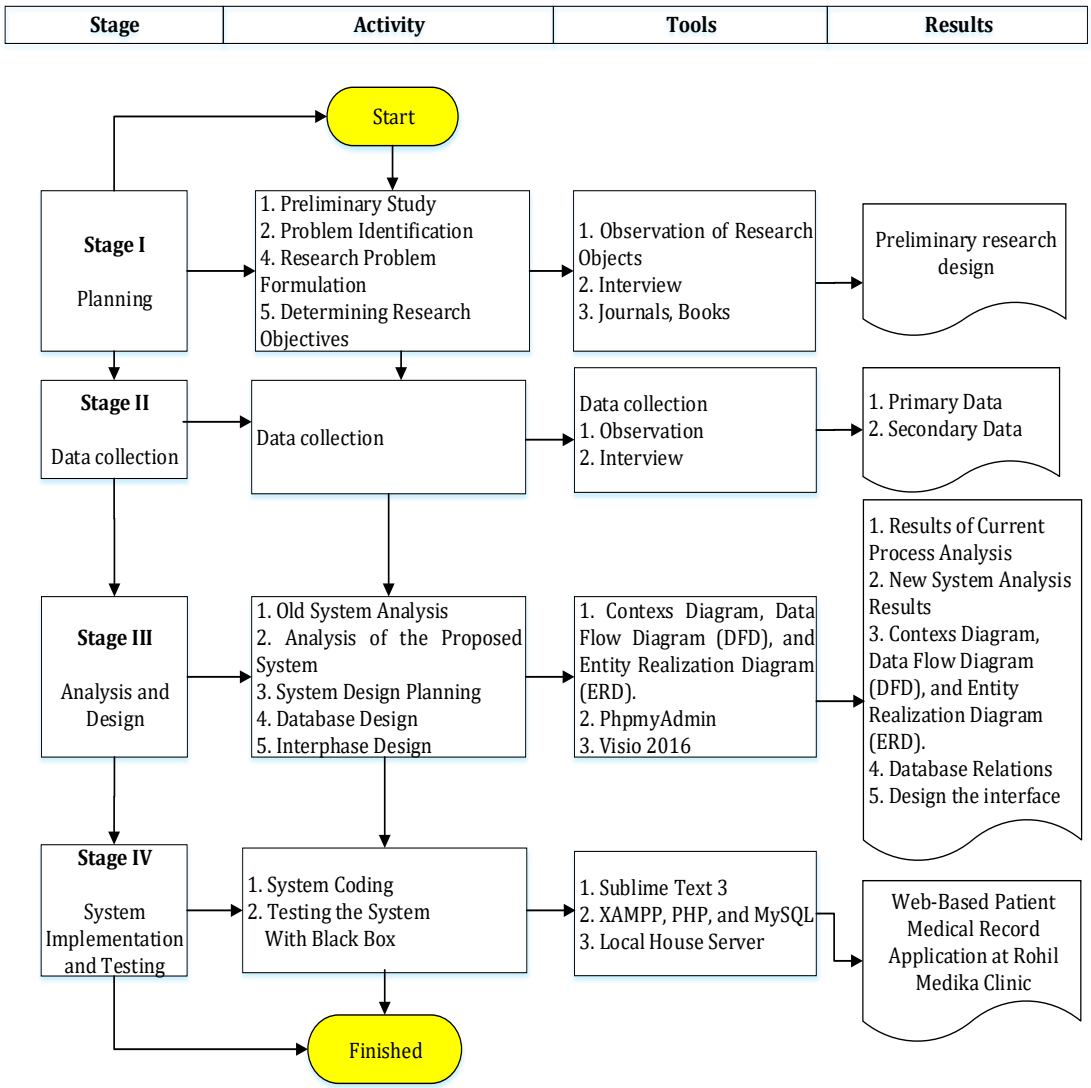

Figure 1. Research Methodology Flowchart

Analysis and Design Phase

The analysis stage is carried out for several analysis activities on the circumstances and situations in the research object. The design stage is carried out to make the details of the system results from the analysis into a form of design so that users understand it [19]–[27]. The steps for system development are as follows:

1. Old System Analysis

The system analysis carried out is an analysis of the system that is currently running and to identify problems that arise in the old system at Rohil Medika Clinic. The system used at Rohil Medika Clinic for the current patient medical record process is a manual system that causes services to

patients to be long, and the process of searching for medical record data is complex, missing patient data, making visit reports that are hampered and archiving data is not neat [28].

2. Analysis of the proposal system

When analyzing the system used at Rohil Medika Clinic today, there are weaknesses in the manual method used at the Clinic. Furthermore, the needs of the new system were analyzed with recommendations for benefits according to the needs of the relevant agencies [29].

3. System design design

After conducting the analysis stage, the next step is to carry out the system design design stage. System design design using 3 diagrams, namely Contexs Diagram, Data Flow Diagram (DFD), and Entity Relationship Diagram (ERD) [30].

4. Database Design

Design a database to identify the tables and attributes used in the system.

5. Design interface

The interface design is a display design that will be every input and output of the system.

System Implementation and Testing Phase

This implementation stage is the implementation of the design stage. To implement the results of the design made earlier, the design must be changed into a form that machines, namely into programming languages, can understand through the coding process. The coding process will produce information systems so system users can use them properly [31].

After coding, proceed with testing the system that has been created. Testing is carried out to determine the system output results with the needs designed at the analysis stage. This system uses the Black Box Testing method at the testing stage, which tests each function in the patient's medical record information system [32].

RESULTS

Proposal System Analysis

Figure 2 is a flowchart of the information system process that will be proposed to overcome the problems in the Rohil Medika clinic.

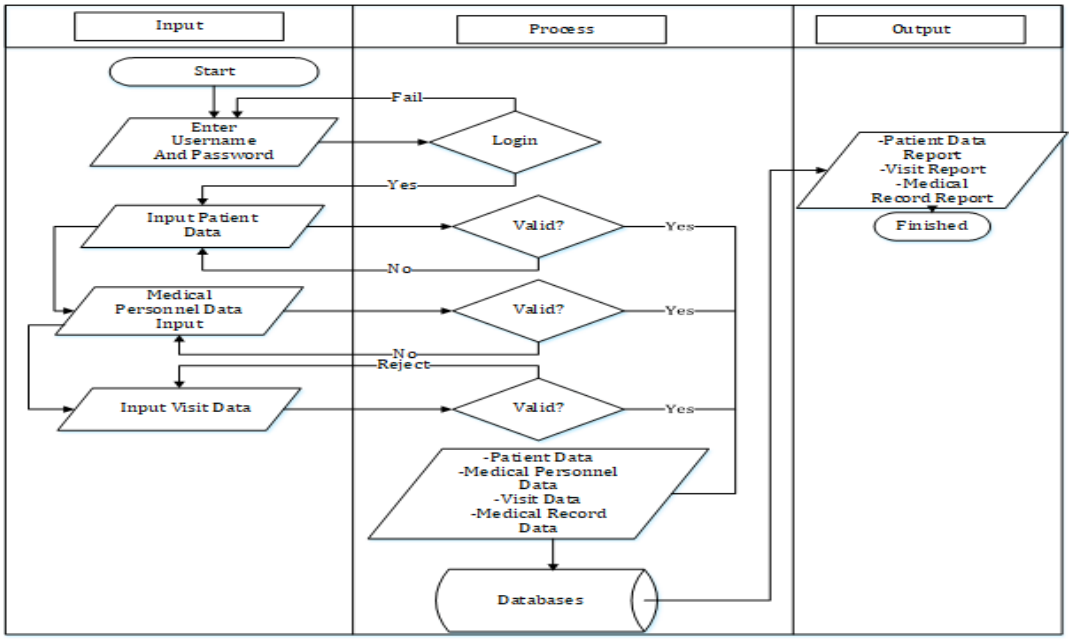

Figure 2. Process flowchart of the information system to be proposed

Context Diagram

The development of the medical record information system at the Rohil Medika Clinic began with designing a context diagram, which was used to describe all the processes contained in the system to be developed. In the Context diagram, there are 2 External Entities, namely users, which include the admin and the head of the Clinic. The context diagram of the medical record information system can be seen in Figure 3.

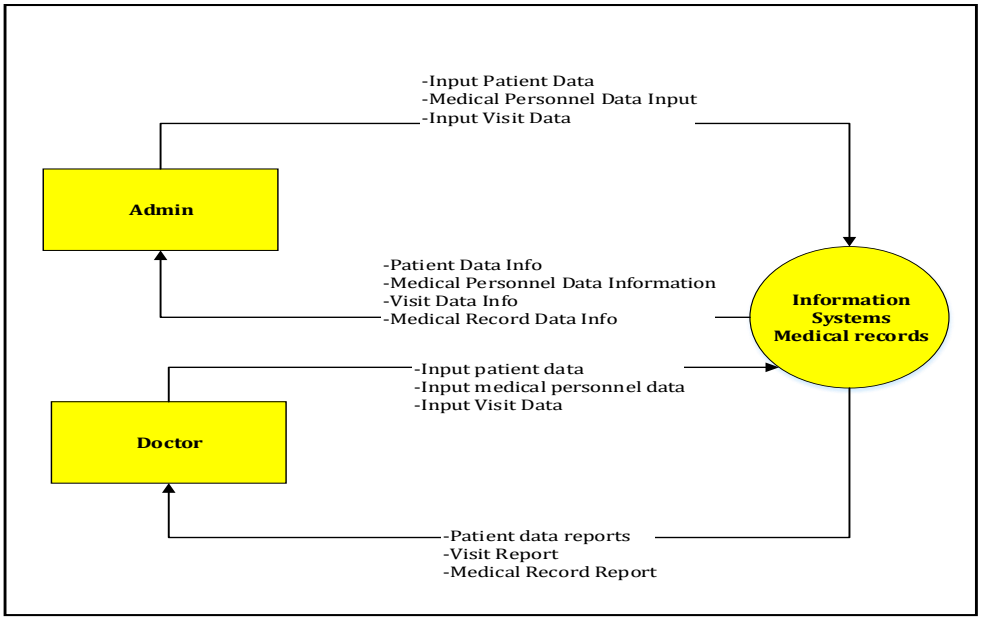

Figure 3. Context Diagram of the Medical Records Information System

Data Flow Diagram (DFD) Level 0

Level 0 data flow diagram in the design of the patient medical record information system of Rohil Medika Clinic is a description of the context diagram, which in this diagram contains input sources (entities). Process storage (data storage and data flow) that will show the data flow in the system can be seen in Figure 4.

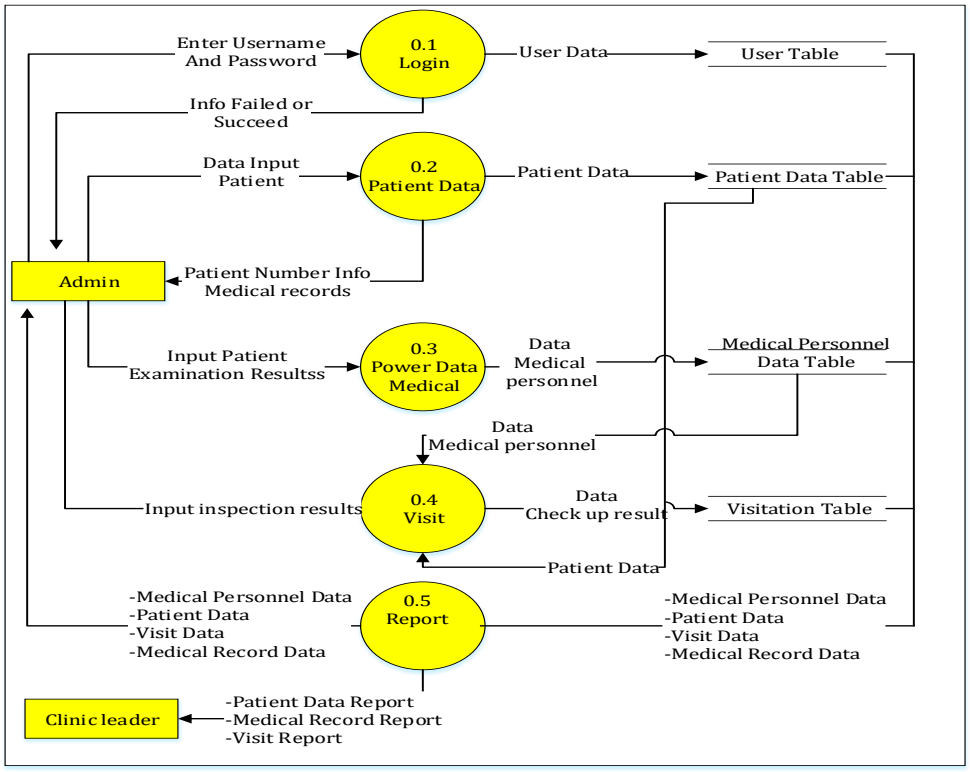

Figure 4. Data Flow Diagram Level 0

Data Flow Diagram (DFD) Level 1 Process 2

DFD level 1 Process 2 is a description of DFD level 0 that describes the system process to the patient and displays the input source (entity). Process storage (data storage and data flow) that will show the data flow in the system can be seen in Figure 5.

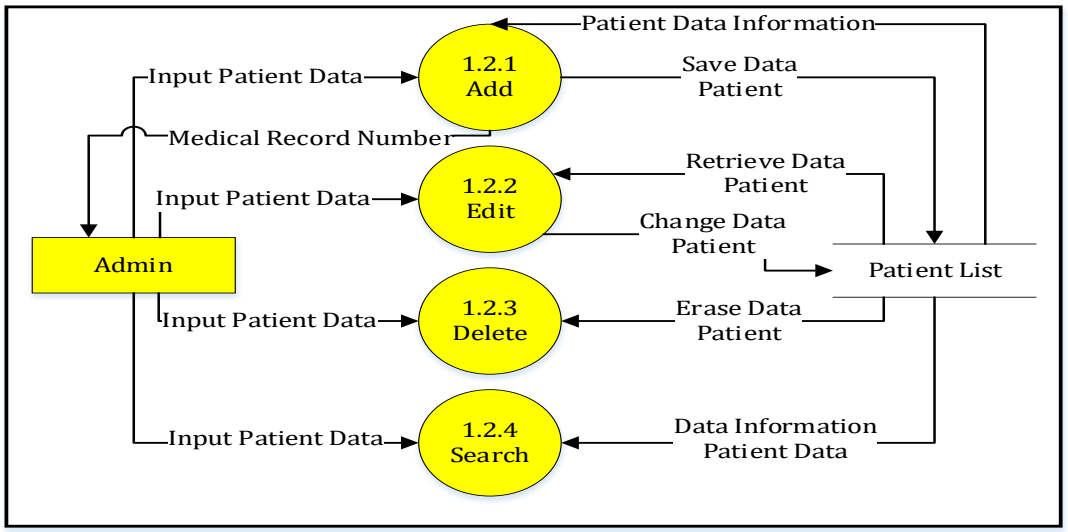

Figure 5. Data Flow Diagram Level 1 Process 2

Data Flow Diagram (DFD) Level 1 Process 3

DFD level 1 Process 3 is a description of DFD level 0 that describes the system process in the workforce that displays input sources (entities). Process and storage (data storage and data flow) that will show the data flow in the system can be seen in Figure 6.

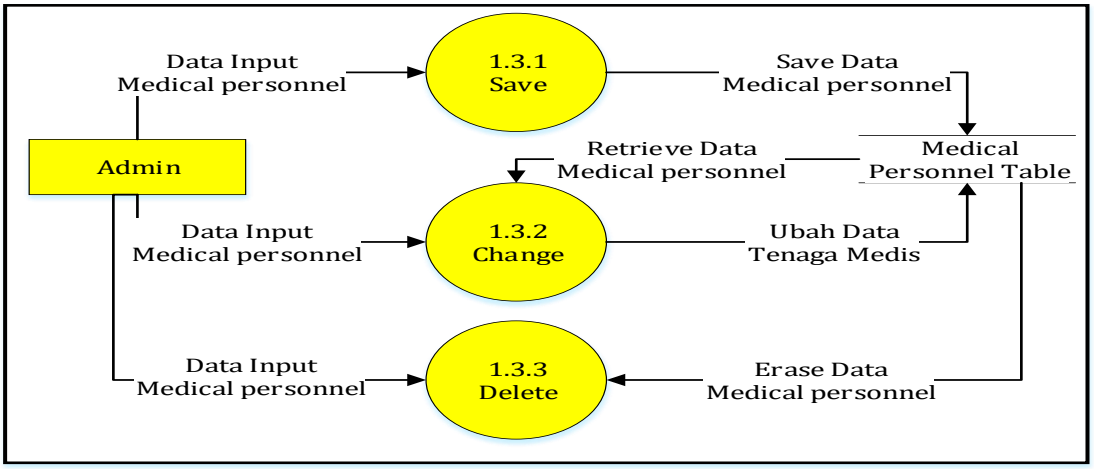

Figure 6. Data Flow Diagram (DFD) Level 1 Process 3

Data Flow Diagram (DFD) Level 1 Process 4

DFD level 1 Process 4 describes DFD level 0, which represents the system process at the visit and displays the input source (entity). Process storage (data storage and data flow) that will show the data flow in the system can be seen in Figure 7.

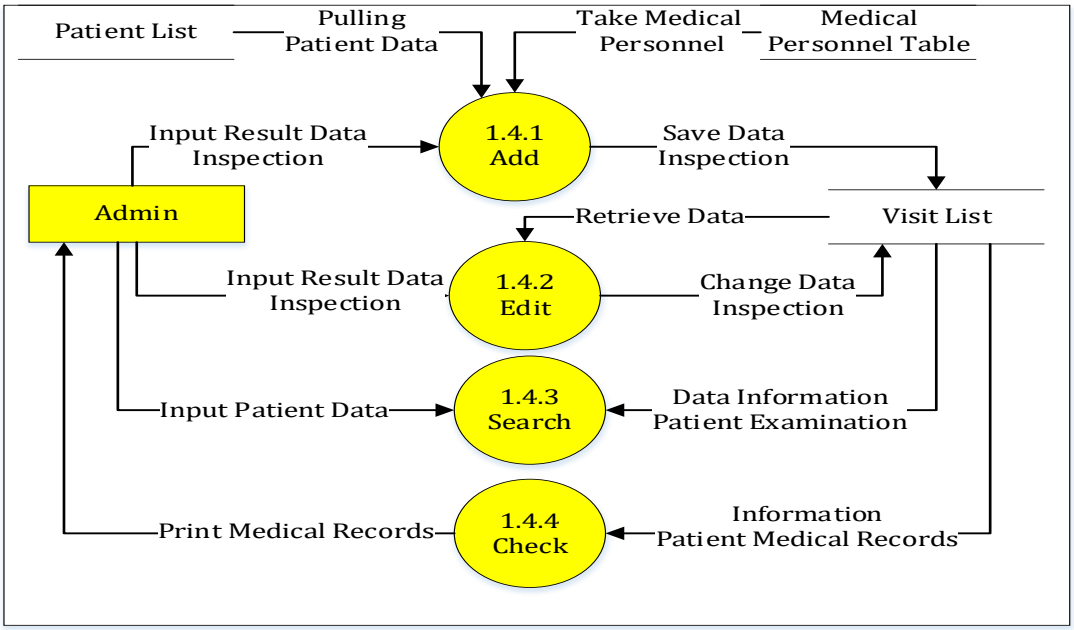

Figure 7. Data Flow Diagram Level 1 Process 4

Entity Relational Diagram (ERD)

The Entity Realization Diagram (ERD) in designing the medical record information system at the Rohil Medika clinic describes the relationships between interrelated entities in one medical record system. The Entity Realization Diagram (ERD) contains the number 1 and the letter N, which shows that the number 1 can only carry out one process while the letter N can carry out several procedures. This can be seen in Figure 8.

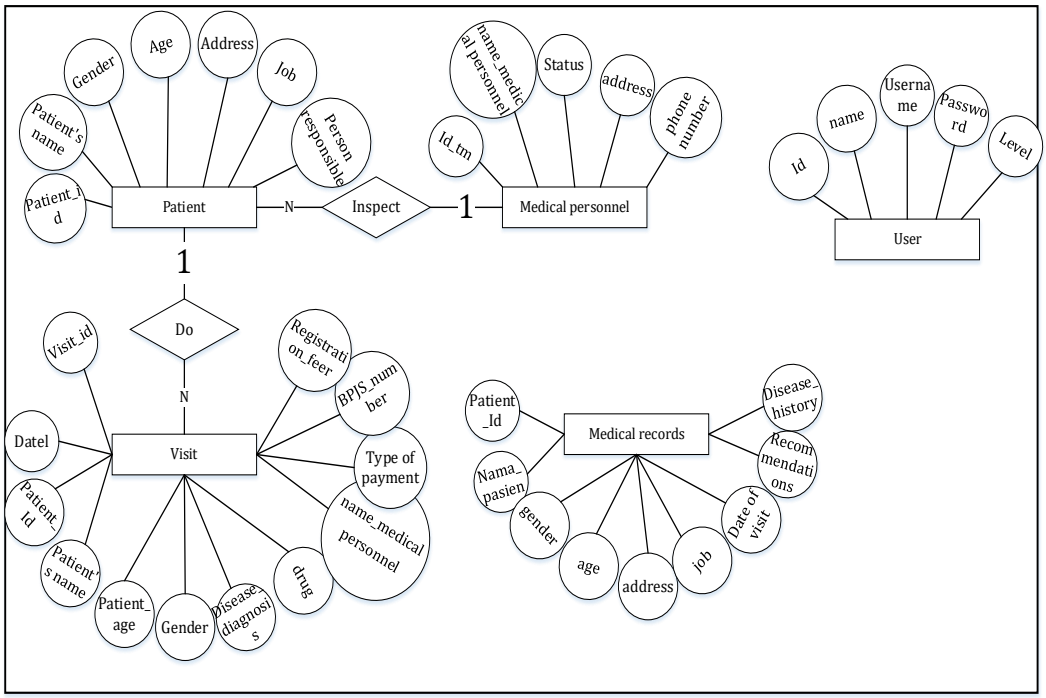

Figure 8. Entity Realization Diagram (ERD)

Website Menu Design

1. Home Menu Design

The design of the home menu in the medical record application is the initial display after the user enters the system. The method of the home menu is shown in Figure 9.

Figure 9. Design the Home Page
(*Design in Indonesian)

2. Patient Data Input Menu Design

The patient data input menu design is used to input data on new patients undergoing treatment at the Clinic, as shown in Figure 10.

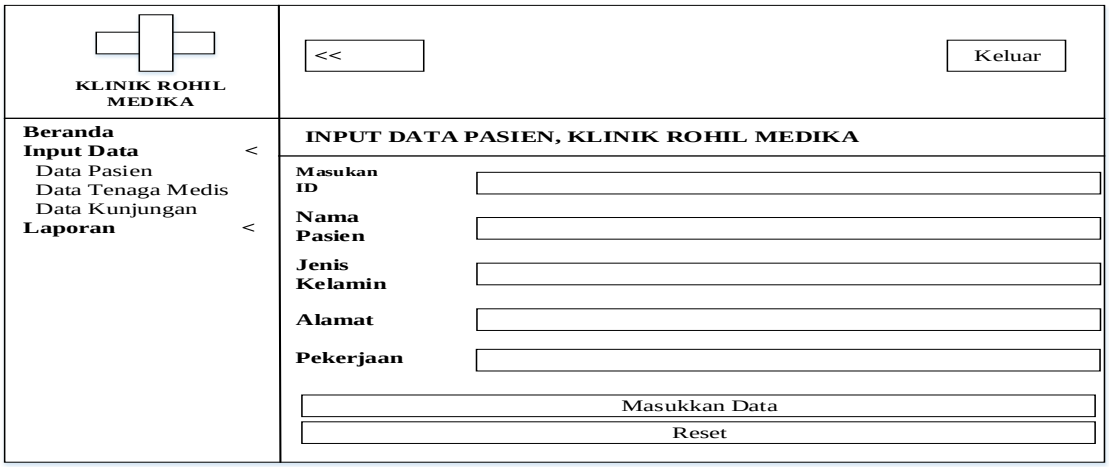

Figure 10. Patient Data Input Menu Display Design
(*Design in Indonesian)

3. Draft Patient Medical Record Report

The design of the visit report is used to display all medical record data of patients who perform treatment at the Clinic that have been inputted by the User into the system, and this plan is shown in Figure 11.

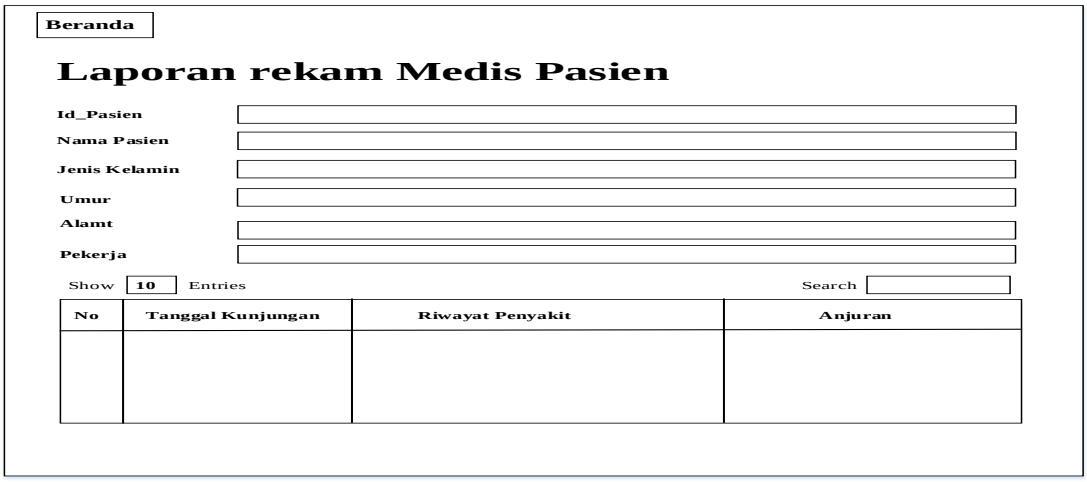

Figure 11. Medical Record Report Display Design
(*Design in Indonesian)

Implementation and Results

At this stage is the implementation of the DFD (Data Flow Diagram) and ERD (Entity Relational Diagram) design stages designed earlier. DFD (Data Flow Diagram) and ERD (Entity Relational Diagram) developed in the previous step are implemented in the form of coding to produce a final system or finished system that can function in natural circumstances and can be known whether the system created successfully achieves the desired goals.

1. Home Page

The home page is the initial display of the user successfully logging in. The function of the homepage display in the medical record system is to display menus needed by users, such as data input and reports. The homepage view can be seen in Figure 12.

Figure 12. Home Page

(*Display in Indonesian)

2. Patient Data Input Display

The patient data input display is used to input data on new patients who perform treatment at the Rohil Medika clinic and provide information on new patient medical record numbers to the admin, which is used to create new patient treatment cards. The new patient data input display can be seen in Figure 13.

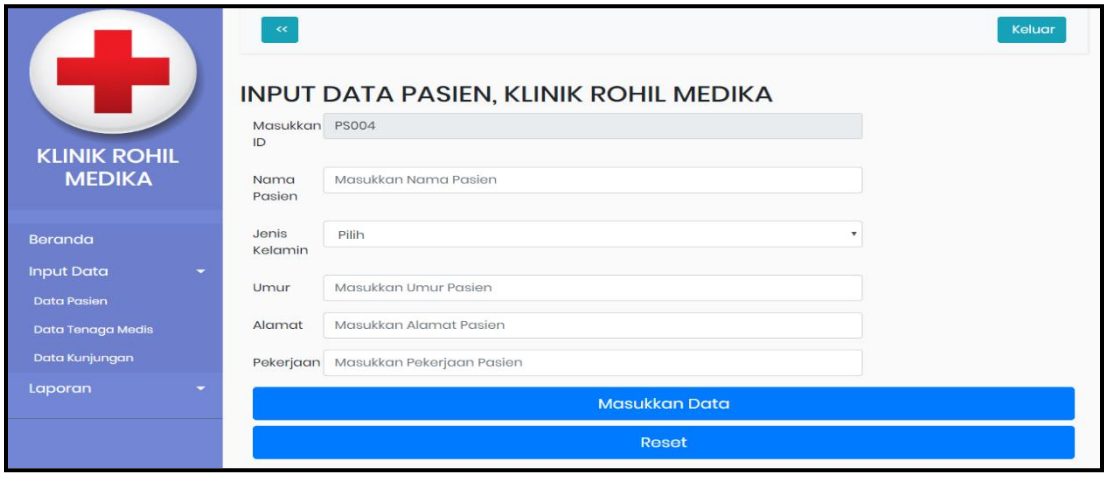

Figure 12. Patient Data Input Page

(*Display in Indonesian)

System Testing

Testing of these systems is an integral part of making information systems. System testing is conducted to test the system's functions so that expectations and needs drive the system. The system testing process relies on inputs and outputs to determine whether the expected results match.

1. Login Testing

Test on the login page to see if the system is running as expected. System testing can be seen in Table 1.

Table 1. System testing on the login menu

No	Purpose	Input	Expected results	System Output
1	Ensure that the Username and Password entered are correct.	Username and Password	Display information that the data entered is correct	SUCCESSFUL Figure 13.
2	Ensure that the Username and Password entered are incorrect.	Username and Password	Display information that the data entered is correct	SUCCESSFUL Figure 14.

Notifications from each system test from Table 1 can be seen in Figure 13 and Figure 14.

1. Notification Input Username and Password is wrong.

Figure 13. Wrong Username and Password
(*Display in Indonesian)

2. Notification Input Username and Password correct

Figure 14. Admin Signed In Successfully
(*Display in Indonesian)

Comparison of Medical Record Applications with Manual Systems

A comparison of the new system, namely a web-based medical record application, with a manual system, was carried out to see the efficiency and effectiveness of the two systems. Seeing the effectiveness and efficiency of the medical record application that has been designed, as many as 10 trials of using the system at Rohil Medika Clinic were carried out to see the performance of the new system. Comparison results of the new system trial utilizing the website with the old system are manually shown in Table 2.

Table 2. Comparison of Time Used by the New System With Manual

Activities	System Used	
	Application Time (Minutes/Patient)	Manual System Time (Minutes/Patient)
New Patient Registration	1.5	8.7
Patient Data Search	0.25	8
Search for Patient Medical Record with Medical Record No/ Patient Name	0.5	6.6
Patient Medical Record Paper Search Without Patient Card	2	6.8
Data Capture 1 Patient	0.5	5.5
Preparation of Medical Record Data	0.5	5.2

DISCUSSION

System testing will be carried out after the patient medical record application has been designed. Testing of this medical record information system uses black box testing. Black box testing on patient medical record applications is used to find errors and demonstrate the application's functionality when operated, whether the input is received correctly, and whether the output is as expected. This is comparable to research [33] in that process testing results on the applications produced in the study showed that the system built worked well, with no errors in the data processing process. Meanwhile, based on system interface testing, it was found that based on usability aspects, 26% of respondents chose very good, 59.4% chose good, and 14.6% chose fair. Based on user aspects, 29% chose very good, 55.2% chose good, and 15.6% chose appropriate. Based on the interaction aspect, 20% chose very good, 50.8% chose good, and 28.9% chose fair.

Testing of patient medical record applications is carried out on the login page, patient data, and visit data. On the login page, there are no errors in the system when operating. Inpatient data with several test commands, there were also no errors in the design, and all orders ran according to system functions. Likewise, the visit data was tested using several commands, and there were no system function errors. The results of testing the medical record application from each menu show no errors in the system. This means the system is designed based on the needs and expected application functions. Research [34] concludes that testing in the user environment uses four parameters: application usefulness, ease of learning, ease of use, and user satisfaction. The evaluation results show that 80% of users agree that the application is valid, 80% agree that the application is easy to learn, and 80% of users are satisfied. 100% of users agree that the application is easy to use. This indicates that this application is practical and helps to archive patient data at the Cemara Clinic. The result of this [35] research is a desktop-based medical record application design that has several facilities such as processing pregnant women's patient data, midwife data, anamnesis data, examiner data, therapy data, drug data, medical record data, medical data reports, and patient data reports. The mother hopes to realize a medical record application to make it easier to record medical records.

CONCLUSION

After analyzing the old system, processing, designing applications, implementing strategies, and testing the system with Black Box testing, it can be concluded that researchers have successfully designed a Patient Medical Record Application at the Website-Based Rohil Medika Clinic using XAMPP Software v3.2.2. The website-based Patient Medical Record Application at Rohil Medika Clinic

has 2 system users: the administration and the head of the Clinic. After testing the use of the Medical Record Application at Rohil Medika Clinic, it can be seen that this application can facilitate administrative work in handling patient administration services ranging from new patient registration, patient examinations, and patient medical records, as well as save time in searching for medical record data, and patient data needed. The system can also present information on daily and monthly reports of patient visits, patient medical record reports, and patient data reports. Officers' inputted data will be automatically stored in the database and neatly archived in the system.

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