Web-Based Health Service Management Information System Development With The Linear Sequential Model Method

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Abstract. The clinic has several health facilities such as outpatient, inpatient, dental clinic, laboratory, family planning/MCH, pharmacy, and pharmacy. However, at the clinic, administrative processes are still carried out manually and are not computerized properly, making it difficult for staff because the process of storing and integrating data has not been carried out effectively and efficiently. Therefore, we need a systematic and automatic information system to assist the administrative and managerial processes of the clinic. The information system developed in this study is based on a web application using the Laravel 8 framework. The method used for system development is the linear sequential model commonly known as the classic life cycle or waterfall development model. The system that has been made is tested using the black box testing method combined with the UAT (User Acceptance Testing) method to find out whether the system meets functional requirements and is by the design. Based on testing using the UAT method, the average value of 6 different indicators is 91%. Therefore, it can be concluded that the web-based information system for this clinic has an easy-to-understand way of working and attractive features so that it can provide convenience in the patient treatment process and clinical managerial processes.

1 Introduction

Management Information Systems (MIS) research has been criticized for its lack of a formal and consistent development methodology, due to its relatively young and rapidly changing nature. A consistent methodological approach continues to be a challenging issue in MIS research, particularly regarding measurement instruments and constructs. [1]

One example of a healthcare facility is a clinic. A clinic is a health facility that provides basic and or specialized individual health services carried out by health workers who have special abilities, skills, and authority [2]. In the clinic workspace, there are administrative management processes such as patient data storage, medical records, patient management data processing, and report generation. At XYZ Clinic are outpatient, inpatient, dental clinic, laboratory, KB / KIA, pharmacy, and pharmacy facilities. However, at the clinic, the administrative process is still carried out manually and has not been computerized properly, making it difficult for officers because the data storage and integration process has not been carried out effectively and efficiently.

Based on the description of the problem above, the author plans to build a web-based XYZ Clinic information system using the Laravel 8 framework so that the XYZ Clinic administration process starting from recording patient data, patient medical records, clinic medical service information, and other data can be integrated properly so that the health service process to patients will run more effectively and efficiently.

Previous research related to information systems for the XYZ Clinic has also been conducted by Muhammad Ghofy Al Hakim entitled, "Health Service Information System at a Web-Based Clinic Using the Laravel 8 Framework". In this study, it can be concluded that the information system created for web-based clinics uses the Laravel 8 framework and the method used in system development is RAD (Rapid Application Development) which includes the requirements plan, workshop design, and implementation stages. There are 2 main features in the information system, namely the inpatient and outpatient registration features where in each feature there is the same content, namely regarding patient medical records including body temperature, height, weight, blood pressure, and diagnosis [3]. RAD uses an iterative (repeated) method in developing systems where a working model (working model) of the system is constructed at the beginning of the development stage to determine user needs (requirements) and then removed [4]. The research conducted by the author uses the waterfall method and has several different features related to filling out medical record forms for inpatients and outpatients, and there are additional features that regulate the process of automating the flow of outpatient treatment. In addition, there are features related to the integration of the drug stock database, making it easier for medical officers and clinic staff to monitor drug stock recaps. There are also additional features to record and recapitulate clinic income for inpatient services.

2 Methods

2.1 Research Methods and Location

The method used in this research is an experimental method with a qualitative approach. The object of this
research is an information system in the form of a XYZ Clinic web. The workflow of this research is described through a flowchart diagram as follows:

Fig. 1. Research Flowchart

2.2 Research Instrument

Research instruments are tools used by researchers to support the research process. In this study, the instruments used include:

- Laptops / PCs (Personal Computers)
- Apache, MySQL, PHP
- Visual Studio Code
- Stackoverflow
- Bootstrap

2.3 System Design, Development, and Testing Method

The method used in developing web-based information systems applications in this study is the Linear Sequential Model commonly referred to as the waterfall model. The waterfall model, sometimes called the linear sequential model, suggests a systematic, sequential approach to software development that begins with the specification of customer requirements and continues through planning, modeling, construction, and implementation, culminating in ongoing support of the finished software. [5]

Fig. 2. Waterfall Model [5]

2.4 System and Software Design

This stage is the stage of creating an overall software architecture design by involving the identification and depiction of the relationship of each element in the system. System architecture design can be described with several types of diagrams. The overall system architecture design is described through a use case diagram which is one type of Unified Modeling Language (UML). Meanwhile, the database design is described through a database relationship diagram.

Unified Modeling Language (UML) is a modeling language for systems or software with an object-oriented paradigm. The basic concept abstraction of UML consists of structural classification, dynamic behavior, and management models. We can understand the main concepts as terms that will appear when creating a diagram and views are categories of the diagram. UML defines diagrams as Use case diagrams, Class diagrams, Statechart diagrams, Activity diagrams, Sequence diagrams, Collaboration diagrams, Component diagrams, and Deployment diagrams. [7].

Fig. 3. Use Case Diagram of Patient Role

Fig. 4. Use Case Diagram of Registration Role
2.5 System Testing

Customer requirements will be validated with this type of testing. User acceptance tests will ensure customer acceptance of what they want to do with the software. UAT tests consist of two levels of testing, Alpha testing and Beta testing.\[6\]

The User Acceptance Testing (UAT) method is carried out by distributing questionnaires to end users who have tried using the system. The questionnaire contains several questions with 5 assessment categories, namely Very Good, Good, Fair, Lack, and Very Lack.

3 Result and discussion

3.1 System Implementation

At this stage, the system design or design that has been made is realized into a web application through program code. The program code created is built using the Laravel 8 framework. At this stage, the database design scheme is also implemented into the web through program code. The main purpose of this system implementation is to reconstruct and verify each program code that produces each feature to build the system as a whole so that it can achieve and meet its functionality specifications.
This page displays an outpatient recap. On this page, the registration role can add outpatient data. After the patient comes to the clinic, the registration department can validate so that the patient's treatment process will proceed to the next process. Then when the nurse and doctor finish examining the patient, they can validate, then continue by the pharmacist and cashier.

This page displays the inpatient recap. On this page, the registration role can add inpatient data. After the patient comes to the clinic, the registration department can validate so that the patient's treatment process will proceed to the next process. Then when the nurse and doctor finish examining the patient, they can validate, then continue by the pharmacist and cashier.

This page displays the patient's detailed medical records, starting from biodata, outpatient medical record documents (Outpatient Integrated Progress Note, Outpatient History, and Outpatient Medication Administration Note), and inpatient medical records (Inpatient Integrated Progress Note, Integrated Management Plan, Outpatient Medication Administration Note, Initial Assessment, Emergency Assessment, Patient Information and Education, and Triage). Doctors have the authority to add or change patient medical records except for Medication Administration Records. Doctors can also change the patient's data except for the Role section.

This page displays a recap of outpatient income within a certain period. The only roles that can access this feature are the cashier role and the admin role.

This page displays a recap of inpatient income within a certain period. The only roles that can access this feature are the cashier role and the admin role.

This page displays a list of stock drugs owned by XYZ Clinic. Pharmacist roles can add or change drug data in the drug stock table. This drug stock table is integrated with CPO_rj and CPO_ri so that the amount will automatically decrease if the pharmacist validates the patient's CPO data.
The practice schedule page displays the practice schedule of doctors who work at XYZ Clinic.

### 3.2 System Testing

System testing is carried out to ascertain whether the features applied to the system can run properly. In this system, there are several feature developments and changes to the database structure to support system functionality by the User Requirement that has been made.

### 3.3 UAT Testing Method

Testing with the UAT method is done by providing a web link to the end user asking the end user to access the link and then trying the features on the Clinic's web system. Then the end user is asked to fill out a questionnaire via Google Form which contains UAT test questions that have been compiled by the author.

The questionnaire was distributed to 24 respondents who are end users of this information system. The end users in question are several people who are likely to become patients of the XYZ Clinic and medical personnel who work at the XYZ Clinic such as doctors and nurses. In addition, there are staff and employees who work at the XYZ Clinic and others such as pharmacists, midwives, and nutritionists.

The assessment is done by summing up the value of each question based on the answers of all respondents, then dividing it by the maximum value (24 respondents x 5), then multiplying by 100%.

Questions on the questionnaire were analyzed and categorized into 6 indicators, namely, appearance, navigation, performance, features, functionality, and overall satisfaction. The value for display indicators is obtained from question number 1. The value for navigation indicators is obtained from question number 2. The value for performance indicators is obtained from question number 3. The value for feature indicators is obtained from question number 4. The value for functionality indicators is obtained from question number 5. The value for user satisfaction indicators is obtained from question number 6.

Based on testing using the UAT method, the average value of 6 different indicators is 91%. Therefore, it can be concluded that this web-based information system for clinics has an easy-to-understand way of working and attractive features so that it can provide convenience in the patient treatment process and the clinic managerial process.

### 3.4 Effectiveness and Efficiency of The Healthcare Process

The web-based information system for XYZ Clinic was created to optimize the Health service process at the clinic to be more effective and efficient. Therefore, a system is said to be effective and efficient if the system can help achieve targets or goals in a fast and cost-effective manner.

To find out whether the web-based information system for XYZ Clinic is effective enough to help the health service process at the clinic, the author conducted field observations and discussions with medical personnel, staff, and clinic owners. Based on the observations and discussions that have been carried out, the results obtained that the outpatient health service process facilitated by a web-based information system will be a faster process of 10 to 15 minutes than the outpatient service process that still uses manual medical records. Several parameters make the health service process with information systems 10-15 minutes faster than the manual health service process, among others:
1. Officers do not need to manually search for patient medical record documents.
2. Patients do not need to manually carry medical record books and hand them over to health workers who will conduct examinations because patient medical records are integrated and computerized.
3. Filling in medical record data can be done through gadgets or other electronic devices such as tablets and laptops.
4. The sequence of processes can be seen transparently, minimizing miscommunication.
5. Patients do not need to submit prescriptions from the doctor to the pharmacist manually, then still have to wait for the pharmacist to prepare the medicine. Because when the doctor has finished making the prescription, it will automatically be integrated into the pharmacist, so the patient only needs to wait for a while.
6. The amount of the bill is automatically written in the cashier's account, so the cashier does not need to calculate the bill manually.

In addition, to find out whether the implementation of a web-based information system for XYZ Clinic is efficient enough or not, a comparison of costs or costs incurred when using a web-based information system and not using an information system is carried out. Based on the results of interviews with the clinic owner, it is known that every year the clinic has to spend a budget for the procurement of 1500 bundles of medical record paper amounting to Rp10,500,000.00 and computer stationery (ATK) amounting to Rp2,000,000.00. Meanwhile, when using a web-based information system for computerizing medical records and clinic managerial, the costs incurred per month are only IDR157,500.00 or IDR1,890,000.00 per year which are allocated for hosting purposes that have
received unlimited database facilities. So it can be concluded that the application of a web-based information system will reduce costs for manual medical records by 84.8%.

Based on field observations and discussions with doctors, staff, and the owner of XYZ Clinic, it is known that the use of a web-based information system will speed up the outpatient service process by 10-15 minutes for each patient. In addition, the application of a web-based information system system for this clinic can save the clinic's expenses for the procurement of manual medical records of IDR 10,610,000.00 or reduce clinic expenses by 84.8% per year. So it can be concluded that the implementation of a web-based information system for this clinic can optimize the health service process so that it is more effective and efficient.

4 Conclusion

Based on the results of the discussion of research entitled Web-Based Health Service Management Information System Development With The Linear Sequential Model Method, it is concluded that the health service management information system has been made by User Requirements and design so that the workings of the information system are easily understood by users and meet functionality needs. In addition, the features of the system are considered to be able to help the data recap process at the clinic so that the treatment process for patients is more structured, effective, and efficient. This was obtained from testing using the UAT method where the system as a whole received a score of 91% from respondents who were end users of the system.

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