

Clinical Information System Using Extreme Programming Method

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Abstract.

Clinic is a health service facility that organizes individual health services and provides basic and/or specialist medical services. If the clinic does not use a computerized system, it will hamper the patient handling process. Obstacles were found at the Rantauprapat Internal Clinic Clinic, including patient registration which was still done manually with patients having to fill out paper forms directly to the clinic, not having a queuing system for treatment, medical record management which was still manual by handwriting. This can take a lot of time in the data search process. The purpose of this application is to facilitate daily operational activities in clinics that run quickly and precisely, as well as medical data management to be more accurate (minimizing human error). The analysis method uses the Soft System Methodology (SSM), and the system development method uses Extreme Programming (XP). This website-based application uses the PHP programming language which is supported by the MySQL database. Based on blackbox testing, all features can run/100% valid. This information system helps the work process in the clinic to be faster, documenting structured medical records, reducing paper use, and facilitating activities in patient care.

Keywords : *Clinic, Website, System Management Software (SSM) and Extreme Programming (XP).*

I. INTRODUCTION

At present the development of technology is increasing rapidly, both the development of android[1], internet of things, machine learning[2][3], robotics[4] and others or what is called the development of industry 4.0[5]. The development of industry 4.0 has entered various fields, for example in the fields of education, health, agriculture, security and others. Likewise with the development of information systems used in various fields. The application of information system technology has penetrated almost all places and business sectors to assist business process activities. One sector of its application in the health sector is the clinic. Clinic is a place and facility for public health services. The application of information system technology can help the clinical service process become faster. The task of the Clinic is to carry out efficient and effective health efforts, compatible and integrated with efforts to improve and prevent as well as carry out referral efforts. The function of the clinic itself is to provide medical services, support services and disease prevention services [3]. The Internal Clinic Clinic is a clinic in Rantauprapat, Labuhanbatu, North Sumatra which is quite crowded with local people. Data service and processing activities at the Internal Clinic clinic only utilize Microsoft Excel for patient data, clinics, diagnoses, drugs, transactions, and other letters, and have not assisted operational activities starting from patient registration, patient queues, recording reports in patient medical record files, payment processing, drug services in pharmacies to processing and presenting data for reports.

These problems cause errors such as patient data discrepancies, the occurrence of the same data recording, the length of the data and information search process, information errors in reports generated, and drug stock data that is not updated which will result in doctors not knowing drug data updates. Of all these problems resulted in a lack of data security and no centralized data back up. Based on the problems found, the researchers will create a "Clinical Information System" to solve problems and facilitate operational activities and assist in improving clinical services. The Extreme Programming (XP) methodology is an approach that is most widely used for rapid software development. The reason for using the Extreme Programming (XP) method is because of the nature of the application which is developed quickly through the existing stages including: Planning, Design, Coding and Testing[6]. The analysis process uses SSM which can help facilitate specific analysis and identification, resulting in a professional Internal Clinic clinical information system.

II. METHODS

2.1. Method of collecting data

a. Interview Method In collecting data, interviews were conducted with clinic staff about ongoing business processes and business processes that should be repaired or updated so that they can develop further.

b. Observation Method

Data collection was carried out by studying books, journals, and writings related to this research. The data collection was carried out by interviewing the leaders of the Internal Clinic Clinic, so that the research produced an optimal data. In addition, data collection was carried out through direct observation, filling out forms, and discussions with group members, so that it could be carried out to the next step, namely making an analysis problems, problem formulation, the purpose of making the system, the benefits of making the system, and the results obtained from developing the system.

2.2. System Development Method

The research method used is Extreme Programming (XP). XP is a fast, efficient, low-risk, flexible, scientific, and predictable software development method. This is intended to deal with unclear requirements. This method emphasizes a development process that is more responsive to customer needs, as well as the basic values that become the spirit of XP at every stage of the software development process[7]. Here, we define quality as a code base that conforms to design specifications and customer expectations as follows:

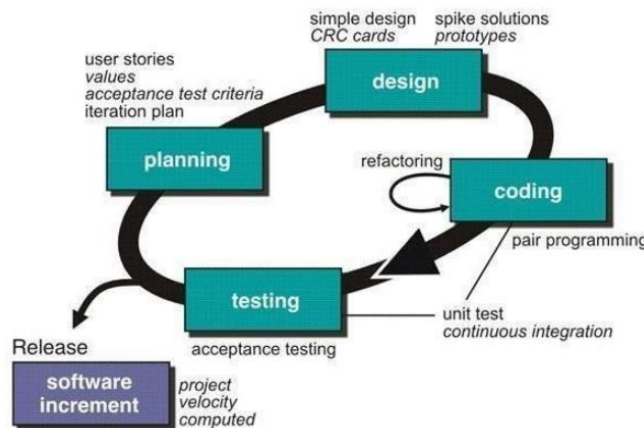


Fig 1. Stages of the Extreme Programming Method

Extreme Programming (XP) has the following stages [8] :

a. Planning

Planning is the initial stage for starting research by defining the required requirements, the outputs to be produced, the services to be developed for the application, and the features and functionality of the application to be developed.

b. Design (Design)

This stage is part of the application design according to the needs of its use.

c. Coding

The coding stage is the stage in preparing code in software that can be used in application development so that it can be a problem solving.

d. Testing

The testing stage is the last stage to test the services or features and functionality contained in the application being built. So that conclusions can be drawn from the tests carried out.

III. RESULT AND DISCUSSION

3.1. Planning

At this planning stage, a needs analysis is carried out using the Soft System Methodology (SSM) method. SSM is an action research methodology aimed at exploring, asking and learning about unstructured

problem situations (soft systems) in order to improve them [6]. The following is an explanation of the SSM stages in this study :

a. Situation considered problematic

Situation Considered problematic is a situational analysis of the context of existing problems. Such as using an offline data input system causes an information system that is less effective and efficient [10]. The process of registering new or old patients is done manually, where the patient must fill out the form provided with a pen, then the patient submits the filled form to the officer to be inputted into the Mc. Excel. Patients will be asked to wait in line and get medical treatment and prescriptions from doctors. After that, the patient must wait for the submission of the prescription and receipt of the drug from the pharmacist, administrative payments, as well as a sick note or patient referral letter. A series of operational activities carried out manually certainly raises many operational problems, including the process that takes quite a long time, the accumulation of paper media used so that data errors are often found, data is lost or damaged, and report presentation becomes inaccurate, where the report will determine the steps taken. important in decision making.

b. Problem situation expressed

At this stage, explaining or expressing the situation, the relationship between users who interact with each other, namely collecting data and information by conducting observations, interviews, and discussions about problems in the clinic. Business process flow at the current Internal Clinic Clinic. In this business process there are only officers, doctors, and patients. Starting from the process of registering patients, examining patients, taking medicines from pharmacists, and making referrals and sick notes.

c. Root definition of relevant systems

Each user is involved in the system and has their own role [12]. such as officers serving patients for clinical administration data, doctors providing diagnoses and prescriptions for patients, pharmacists dispensing drugs and closing administration with requirements. Whereas in the CATWOE element analysis - (Client, Actor, Transformation, World view, Owner, Environment) [13] as follows:

- 1) C (Customer): patients, officers, doctors, clinic heads, and pharmacists at the Internal Clinic clinic.
 - 2) A (Actor): officers, cashiers, doctors, pharmacists at the Internal Clinic clinic
 - 3) T (Transformation): all operational activities are carried out manually, so the service process is slow and the risk of data errors is high → Designing an integrated information system to facilitate all clinical operational activities
 - 4) W (World View): can accelerate and improve the quality of clinical services.
 - 5) O (Owner): owner of the Internal Clinic clinic.
 - 6) E (Environment): IT infrastructure support, communication between stakeholders
- d. Conceptual models of systems are described in root definitions

Each user has a relationship between one user and another. For example, officers have a relationship with doctors because the role of officers is to provide administrative services that must be prepared to be given to doctors. The doctor's role is related to that of the pharmacist, because the doctor gives prescriptions, sick notes or referrals to patients to be submitted to pharmacists. and the pharmacist's role is to provide drugs according to the doctor's prescription and close the administration with payment.

e. Comparison of models and real world

Based on the results of direct observation, that the running business processes have not developed an information system. So that it can affect patient service and clinical quality.

f. Changes systematically desirable, culturally feasible

In terms of developing the Internal Clinic clinical services, it is offered to create a computerized system that is good and data that is interrelated between user roles and other users.

g. Action to improve the problem situation

The result of the development plan is the creation of a clinical information system that can be managed by all users on a client-server basis with the same data without having to repeat existing data, and data can be real time .

3.2. Design (Design)

The initial stage in designing this application is making a Use Case Diagram:

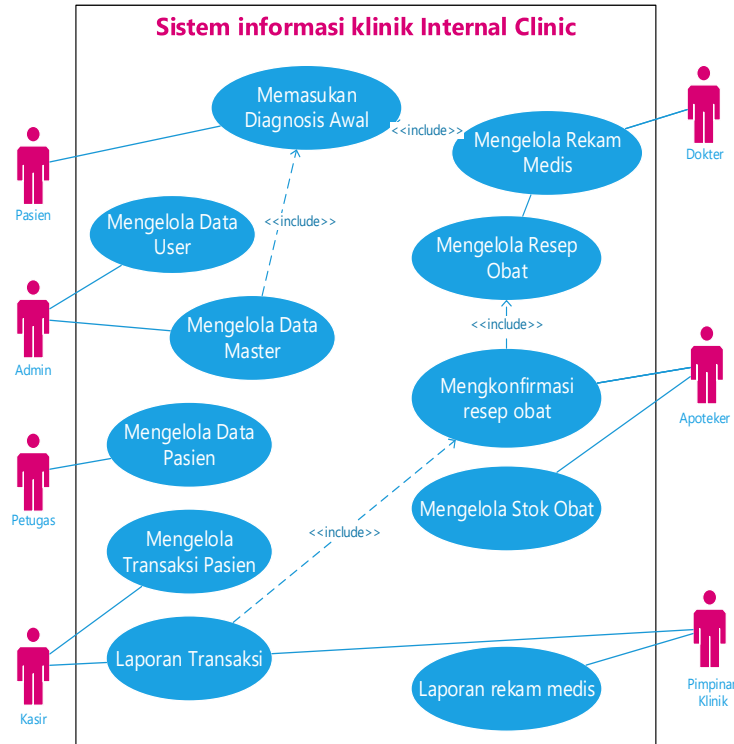


Fig 2. Use Case Diagram of Clinical Information System

The diagram above illustrates the function of the new clinical registration information system where all users have access according to the needs that have been analyzed in the planning stage. The next design stage is to create Database Design.

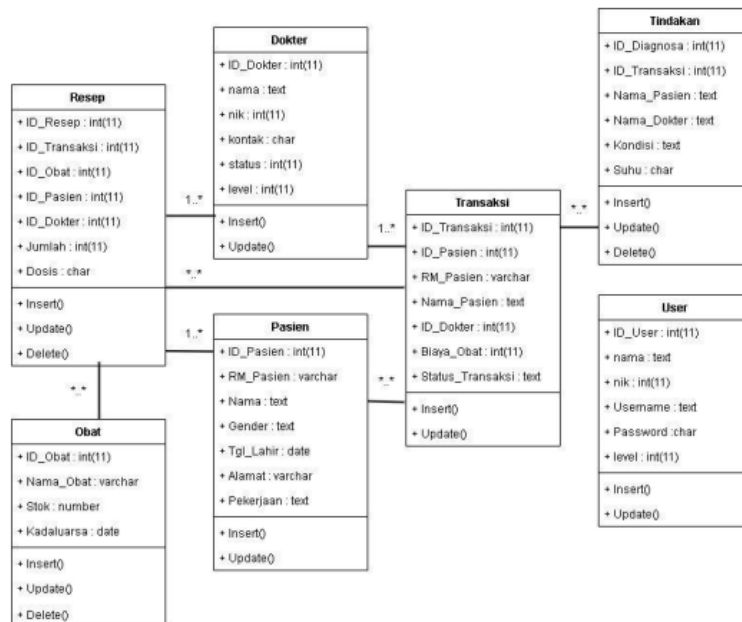


Fig 3. Database Design of Clinical Information System

3.3.Coding The next stage is implementing the design that has been made into an application/program according to needs [15].

3.3.1 Input Data pasien

It is the initial input of the patient's condition through several questions (parameters) into the system, making it easier for doctors to provide actions and prescriptions.

No	ID Pasien	No. RM	Nama Pasien	Kelamin	TTL	Usia	Alamat	KTP	No.Asuransi	No.Tip	Status Kawin	Aksi
1	9	1010	a	a	aa	a	a	a	a	a	a	Edit Print
2	8	000020	Dona	Perempuan	Rantauprapat	45	Rantauprapat	p	pp	p	p	Edit Print
3	7	1010	a	a	a	a	a	a	a	a	aa	Edit Print
4	6	000010	Agus Setiawan	L	Rantauprapat 20 Juni 1980	38	sei tawar	123456789	-	085233333333	kawin	Edit Print
5	5	000001	Budi	L	Rantauprapat 20 Mei 1974	80	Jl cut nyak dian no.25	123456789	-	085288888888	kawin	Edit Print

Fig 4. Patient data

3.3.2 Patient Diagnostic Input

Stages in entering initial diagnosis data into the system before seeing a doctor. The goal is to make it easier for doctors to diagnose patients and to shorten the doctor's visit time so as to minimize queues.

3.3.3 Patient Payments

The picture above shows the management of billing (payment) for actions, prescriptions and drugs that have been given to patients.

No	Nama	Harga	Qty	Diskon	Subtotal
1	Ganti Perban	IDR 100.000	1	0%	IDR 100.000
2	USG	IDR 150.000	1	0%	IDR 150.000
Gren Total					IDR 250.000

TOTAL IDR 250.000
TERIMA IDR 300.000
KEMBALI IDR 50.000

Fig 5. Patient Payments

3.3.4 Financial statements

No	Kode Barang	Nama Barang	Satuan	Harga Pokok	Harga Eceran	Qty	Subtotal
1	BR000001	Ganti Perban	Keg		Rp 0	1	Rp 100,000
2	BR000002	USG	Keg		Rp 0	1	Rp 150,000
Nofaktur: FA000004 User: administrator Tanggal : 09/08/2020							Rp250,000
1	BR000002	USG	Keg		Rp 0	1	Rp 150,000
2	BR000001	Ganti Perban	Keg		Rp 0	1	Rp 100,000
Nofaktur: FA000003 User: administrator Tanggal : 07/08/2020							Rp250,000
1	BR000002	USG	Keg		Rp 0	1	Rp 150,000
2	BR000001	Ganti Perban	Keg		Rp 0	1	Rp 100,000
Nofaktur: FA000002 User: administrator Tanggal : 06/08/2020							Rp250,000
1	BR000002	USG	Keg		Rp 0	1	Rp 150,000
2	BR000001	Ganti Perban	Keg		Rp 0	1	Rp 100,000
Nofaktur: FA000001 User: administrator Tanggal : 04/08/2020							Rp100,000

Fig 6. Financial statements

3.4. Testing

Is the last stage to test the services or features and functionality contained in the application being built.

Table 1. Blackbox Testing of Clinical Applications

Number	Page	Desired output	Results Displayed	Status
1.	Main page	Displays the main page	Successfully displays the main page	Valid
2.	Login page	Displays a form to fill in the correct username and password. If incorrect, you will be asked to enter the correct username and password.	The username and password are correct, so the user can successfully enter the system. If incorrect, then the user is asked to re-enter the correct username and password.	Valid
3.	User data update page	Display the user's personal data page and click save to save data changes.	Personal data can be updated properly, and stored in the database	Valid
4.	Patient registration page	Displays several questions (parameters) to get the patient's initial diagnosis	Parameters successfully displayed	Valid
5.	Pages include diagnoses, actions and prescriptions.	Displays a form to fill in conditions, complaints, doctor's diagnoses, action input, and prescription input. If you click save, the data will be stored in the database	Successfully displays the form of diagnosis, action, and prescription, data is stored	Valid
6.	Payment page	Displays patient data, doctor's actions, prescriptions, and a form to fill in the patient's payment amount	Successfully displays patient data, prescription actions and payment forms	Valid
7.	Report page	Displays a list of required reports, for example sales reports, transaction reports and others.	Successfully displays the required reports, for example sales reports, transaction reports and others.	Valid

IV. CONCLUSION

Based on the research that has been done, the authors can conclude that this Clinical Information System can produce reports or information as needed, making it easier for management to make decisions for clinical progress and can help facilitate all officers. Suggestions that can be given for further research are the development of applications regarding clinical financial reports, direct integration with insurance and BPJS, further development of features so that patients can carry out online and android-based consultations. System implementation needs to be followed by evaluation to find out system weaknesses, so that further development can be carried out according to IT developments and needs.

V. ACKNOWLEDGMENTS

The authors thank the Internal Clinic for supporting this project and the entire staff and Labuhanbatu University.

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