

Application of Scrum Methodology on Medical Record Development

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Abstract: Along with the development of information and communication technology (ICT) has been influential for change on all fronts, including health sector especially in the process of medical record data storage which is called with the electronic medical record. Yet most hospitals in Indonesia at the moment still rely on the medical record using paper files including Siloam Hospitals in Bali and TB Simatupang where this hospital became the location of the study authors. So it could be said to get to the electronic medical record implementation is still far away. The existence of information and communication technologies in the medical record Department currently can be used to its full potential, it can be seen from the way of making the report, the provision of patient information, data management application which uses diagnosis worksheet by means of input data that is in the file to an excel document that is already in the prepare in advance. The impact of this is the duration of the provision of the information having to input and manipulate data that is already in the input it manually. Based on these problems, the authors tried to make a prototype module medical records by using a systems development method SCRUM is part of Agile Development where the focus point to the application's speed and user satisfaction. Scrum has its own characteristics that are looping at each milestone in its development other than that this methodology can adapt to any changes that occur. The results want to achieve from this research is the creation of a Prototype module Medical Record where functionally tested and complies with users needs and can support the performance of the Department of medical records in the hospital so that more effective in service to patients and also capable to passing the blackbox test which stressed to the standard dimensions of the quality of the Content web application, Function, Structure, Usability, Navigability, Performance, Compatibility, interoperability, and security.

1 INTRODUCTION

In carrying out its role, the medical record department has several problems in processing data that will later be made into reports, the first problem is to make reports they must input all information in the patient's medical record file into the worksheet application one by one to be processed into reports daily, weekly or monthly. This results in the performance of the medical record department being inefficient and ineffective. The second problem that often occurs is the limited information on the last location of where the patient's documents were last used; this is because medical record documents are possible to move hands in one episode of patient service, to resolve this medical record tried to solve the problem using a log book manual. The third problem that becomes a new problem in medical records is that in serving BPJS patients, the medical

record department must use an additional application namely INACBG and SEP provided by the Indonesian Ministry of Health. Also, they must prepare other patient documents that must be attached to support the BPJS report in order to make a claim.

Out of the several problems mentioned above, it is necessary to design an electronic medical record system that accommodates a patient's medical record in a centralized database. Centralized storage referred to here is a condition in which outpatient medical records, hospitalizations, emergency care, diagnostic information, actions, drugs consumed and the results of checking both laboratory and radiology stored in a storage database. Then the ability to be integrated with services outside the medical record itself such as BPJS.

1.1 Problem Identification

Based on the background in this research, the following problem identification can be formulated :

1. Application
2. How hospitals can easily obtain medical record information from patients

1.2 Research Purpose

1. Analyze the need for development
2. Make a prototype of medical record module

1.3 Medical Record

Medical record is: *“The collection of information concerning a patient and his or her health care that is created and maintained in the regular course of business in accordance with policies, made by a person who has knowledge of the acts, events, opinions or diagnoses relating to the patient, and made at or around the time indicated in the documentation”.* (IFHRO: International Federation of Health Records)

1.4 Software Process

The software process is a framework for activities, actions, and tasks needed when building a software [PRE, 2014].

The process framework establishes a complete software engineering process by identifying a small number of activities that apply to all software projects, regardless of the size or complexity (Pressman, 2010).

1.5 Scrum Methodology

Scrum is a framework for developing and managing complex products. Scrum can be used to solve complex problems that are constantly changing, which at the same time produce products of the highest value possible creatively and productively (Schwaber and Stuhlerland. 2014).

Scrum has been used to manage complex product development since the early 1990s. Scrum is not a process or technique for developing products; more than that; it is a framework where various processes and techniques can be included.

1.6 Software Testing

The software is tested to reveal errors that were made accidentally when the software was designed or built (Pressman, 2010).

Software testing is the process of running and evaluating a software manually or automatically to test whether the software meets the requirements or not (Clune,2011) and (Nakagawa and Maldonado, 2011). In short, testing is an activity to find and determine the difference between expected results and actual results.

A software test can be done after the engineer builds the implementation of an abstract software concept. Software testing is basically meant to "unload" the software that has been built.

1.7 Research Framework

Systematic thinking framework for problem-solving related to the object of research, in the form of relationships between concepts resulting from theories and various other related/relevant supporting factors, which have been defined previously as important problems can be seen in the figure below.

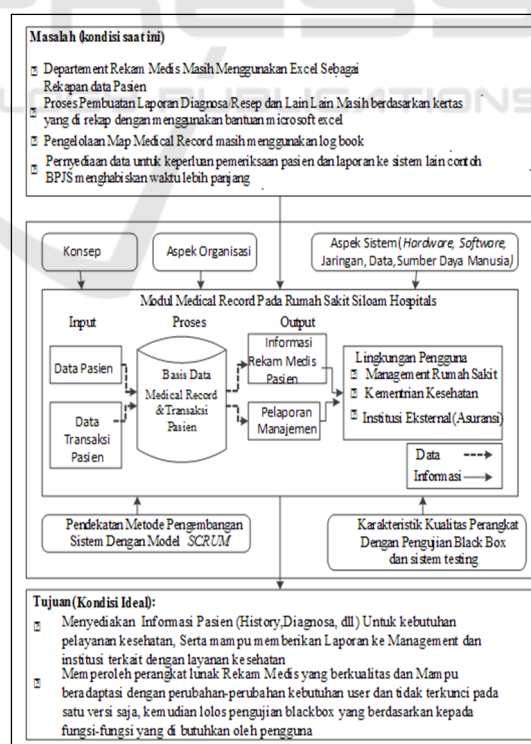


Figure I Research Framework

1.8 Hypothesis

Based on the conceptual framework that has been proposed, this research statement can be formulated as follows:

Allegedly the quality of the medical record module prototype was made using SCRUM development method if it is repeatedly tested every time the addition of submodules is based on the black-box technique, by looking more at the functions needed by the user and combined with the testing system where the application prototype is, then the prototype can be used in the Production environment and can be directly applied to support the performance of the medical record department.

1. Having a duty and responsibility as the Head of Department or a leader at Medical Record Department in a hospital
2. Having experience in Medical Record field for more than 3 years
3. Having experience in the field of Hospital Management for more than 3 years.

Respondents in this study were Head of Departments and Senior Staffs at Medical Record Department in Hospitals. The selection of sample respondents is based on the criteria that have been explained previously and that the medical record system prototype developed will be used by the medical record department in the hospital, so the sample is very representative.

2 RESEARCH METHODOLOGY

Research on the development of this medical record module prototype is a type of applied research. The result of this research can be directly applied to solve the problems faced (Moedjiono, 2012).

This research will apply Agile development model using SCRUM system development method which was documented by collecting all BackLog (User Needs) to be made into small modules to determine the priorities to be later analyzed and formed into a basic foundation to build a continuously developing Medical Record Module to accommodate hospital needs. The results of each analysis will later be made into a medical record application module using the PHP programming language and SQLSERVER database; then the application was tested based on the functions required by the user before being demonstrated to the end user.

2.1 Sample Selection Method

The sampling method in this study was purposive sampling. Purposive sampling is a sampling technique by taking the selected respondents correctly picked by the researcher according to the specific characteristics possessed by the sample (Nasution, 2009).

The criteria for selecting respondents in the sample of this study are :

2.2 Analysis Technique

In the analysis process, there are four analysis steps conducted :

1. Analysis of ongoing medical record
2. Analysis of users. At this stage, an analysis of the user's representative is used to use the application that will become the Product Owner.
3. Analysis of functional and non-functional needs. And also what functions are usually obtained by each user by being modeled using Product Backlog. Functional needs modeling is done with the Sprint Backlog
4. System Behavior Analysis
5. In this stage, analysis of the system behavior that will be developed and modeled with the Document Design which contains the Procedures contained in the Sprint at the SCRUM stage is carried out.

2.3 System Design Plan

Medical record module prototype design technique that will be used in this study is SCRUM Methodology as a reference in developing software. Where there are several stages:

1. Collection of all product user needs along with the priority scale of workmanship and estimating the time needed to complete this matter called the Product Back Log stage.
2. The result from the Backlog Product broken down into more detailed form and tasks that will be done by the team is called the Sprint Backlog stage.

3. The third stage is called Sprint, which is the process of doing all the work that has been defined. This stage is a recurring stage until all the needs of the user packaged in the form of a backlog are met. To find out whether it is in accordance with the backlog, a demo is needed for the user everyday.
4. The final stage is called the Deliverable, which is to combine all the results of the sprint and then do a thorough test (System Integration Testing) and see if there's any backlog left or need to add more backlog.

In this study, system quality testing is carried out to test the level of software quality. System testing techniques carried out in this study used a black-box testing approach to determine the behavior of applications externally and testing of web applications by focusing on the standard dimensions of web application quality such as Content, Function, Structure, Usability, Navigability, Performance, Compatibility, interoperability, security [PRE 2010] in the following ways:

1. Acceptance testing using a questionnaire distributed to system users with black-box testing techniques to answer the following questions.
 - a. Were the existing functions compatible?
 - b. Were there any errors in UI?
 - c. Were there any errors in flow data in the application?
 - d. How was the application performance?
2. Web application testing divided into 7 parts :
 - a. Test the content of the web application to see if there's an error
 - b. Test the display to ensure that all cases can be accommodated
 - c. Test the navigation link in the application
 - d. Test the existing functions
 - e. Testing compatibility in different environments such as operating systems, browsers, and different hardware.
 - f. Test the security of a web application to find out if there's a gap that can be bypassed
 - g. Test the application's performance

2.4 Research Steps

Research steps planned by researchers in order to research by the conceptual framework/mindset of

problem-solving as shown in the figure below.

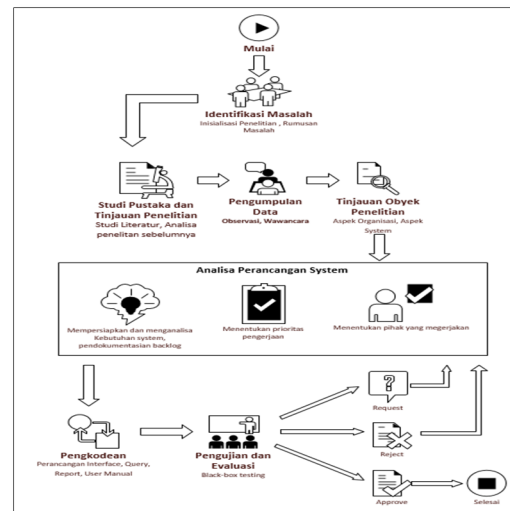


Figure 2. Research Steps

2.5 Analysis of Human Resource Needs

To develop this medical record module prototype, it takes human resources to be allocated in several sections as follows.

1. Scrum Master

Scrum Master Acts as a bridge between application users (StakeHolder) in providing multiple user stories and comments on every work that can be conveyed, Aside from that, the Scrum Master is responsible for defining the estimated work that will be given to the developer. Here the researcher himself is the Scrum Master.

2. Scrum Team (Developer)

This team is divided into 3 parts :

A Database Administrator that functions to analyze existing resource database tables, design a new table, then create a query to put in a model that will be accessed by the Programmer's backend, this Database Administrator will also be assigned to create reports.

Backend Programmer is responsible for creating a logic application which utilizes the data from the dba before finally being thrown into the frontend developer.

Frontend Development is tasked with presenting a defined application interface by using a mockup sketch. Frontend Development must have an thorough backend understanding because every data on the user's screen comes from a function created by the Backend developer.

3. StakeHolder/ Product Owner

The StakeHolder / Product Owner here is the end user of the application. Their job is to define each user story according to the needs they need. Then comment on all the results given.

2.6 Work Weight Decision

Table IV.2 Work Weighting (backlog)

Work	Weight
Can see all patient data registered in the hospital	10
Can see patient's detailed information. Age, Active Status, Residence, Gender, Last Doctor	10
Can input Visiting Patient's Diagnosis Data based on the data provided by doctors	10
The system provides ICD 10 diagnostic data and ICD 9 CM according to the latest WHO format so that there will be no errors when inputting the data	10
Input diagnosis is required for every episode in the system. It is mandatory	10
Can find out about new patients	10
Can see list of patients who have made an appointment that day	10
Can see detail of patient visitation history which are based on medical record numbers	10
Can see what services are being performed to the patient, so that they can enter the Action Code (ICD 9CM) accordingly	7
Can input SOAP in the system. If SOAP is in the paper, then the system will automatically be inputted. Subjective is available on paper.	7
System can conduct daily census of inpatients	7
Can conduct census reports everyday	7
In the registration system, screen to send documents will be prepared by clicking on documents receiving	6
Can make diagnostic reports per time period.	6
Can see the doctor's prescription complete with consumed medication and the notes given per episode	5
Can view laboratory examination report complete with detailed reference range per episode	5
Can see results of radiology examinations made by radiology doctors per episode	5
Can see patient visitation report based on LOB based on the time range	4
Can display information confirming BPJS patients	4
Can input data to INACBG from medical record system, thus no need for many applications	4
Can print participant eligibility letters from medical record modules per episode	4
Can see BPJS patient reports completely with their SEP number	4
Can display and confirm BPJS patients	3
Can issue document delivery Turn round Time Report	2

2.7 Architectural Design

The application architecture that will be used for the development of this module is the PHP programming language using the CodeIgniter Framework that has adapted the modular MVC concept and can adopt web service technology. By using the MVC concept, the team can focus on working on the field. For DBA all queries are placed in one file packaged in the Model. Then for the backend programmer, will only consume data from the model provided by the DBA and writes all logic in the controller. For frontend programmer, will only work in the view folder by coordinating to all the functions in the controller. Both in the form of POST parameters and GET parameters.

For the development of the architecture display, we used Twitter Bootstrap framework which is combined with JQuery that handles every AJAX request and the additional Data tables plugin to access the JSON data provided by the controller. Aside from that, with this jquery on the client side, it will be able to process data before it is stored in the database. The reason for using this architecture is an effort to streamline bandwidth usage in accessing web pages.

For the needs of the architectural report, we used open source software with Jaspersoft Report. This software is web-based and can run only by providing a template report that has been inserted with a query and configured to connect to the database.

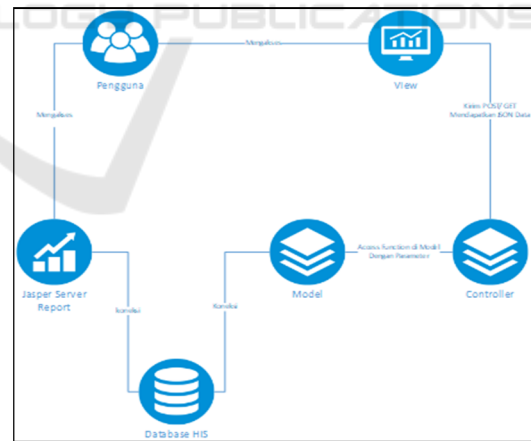


Figure 3. Medical Record Module Prototype System Architecture

3 SOFTWARE TESTING

3.1 Black Box Testing

For this test, the Backlog approval form is distributed to 2 hospitals, and 4 respondents consist of 2 Head of Department of Medical Records and 2 Senior Medical Record Staff who will represent the rest of the staffs. The points tested are the backlog that has been defined based on the results of the collective agreement. The contents of the backlog form contain the approval from the user story which was previously described. One backlog will be declared Pass or accepted if all user stories are declared appropriate. Moreover, each form will be signed by the respondent.

Test results have been conveyed in the design of the backlog. The following is a summary of the Medical Record Module Work based on the previously defined backlog.

Table IV.4 Summary of Test Results for the Backbox for each Backlog

<i>o</i>	<i>Task Name</i>	<i>Weight</i>	<i>Delivery Date</i>	<i>Testing Pass Status</i>
	Can see all patient data registered in the hospital	10	05/11/2014	Pass
	Can see patient detail information. Age, Active Status, Residence, Gender, Last doctor.	10	05/11/2014	Pass
	Can input Visiting Patient's Diagnosis Data based on the data provided by doctors	10	07/11/2014	Pass
	System provides ICD 10 diagnostic data and ICD 9 CM according to the latest WHO format so that there will be no errors when inputting the data.	10	07/11/2014	Pass
	Can find out about new patients	10	07/11/2014	Pass
	Can see list of patients who have made an appointment that day	10	07/11/2014	Pass
	Can see detail of patient visitation history which are based on medical record numbers	10	07/11/2014	Pass
	Can see what	7	10/11/2014	Pass

<i>o</i>	<i>Task Name</i>	<i>Weight</i>	<i>Delivery Date</i>	<i>Testing Pass Status</i>
	services are being performed to the patient, so that they can enter the Action Code (ICD 9CM) accordingly			
	Can input SOAP in the system. If SOAP is in the paper, then the system will automatically be inputted. Subjective is available on paper.	7	07/11/2014	Pass
0	System can conduct daily census of inpatients	7	10/11/2014	Pass
1	Can conduct census reports everyday System can conduct daily census of inpatients	7	10/11/2014	Pass
2	The system can give the status that the patient's document came out	7	10/11/2014	Pass
3	In the registration system, screen to send documents will be prepared by clicking on documents receiving	6	17/11/2014	Pass
4	Can make diagnostic reports per time period.	6	12/11/2014	Pass
5	Can see the doctor's prescription complete with consumed medication and the notes are given per episode	5	12/11/2014	Pass
6	Can view laboratory examination report complete with detailed reference range per episode	5	12/11/2014	Pass
7	Can see results of radiology examinations made by radiology doctors per episode	5	12/11/2014	Pass
8	Can see patient visitation report based on LOB based on the time range	4	12/11/2014	Pass
9	Can display information confirming BPJS patients	4	28/11/2014	Pass

o	Task Name	Weight	Delivery Date	Testing Pass Status
0	Can input data to INACBG from medical record system, thus no need for many applications	4	28/11/2014	Pass
1	Can print participant eligibility letters from medical record modules per episode	4	28/11/2014	Pass
2	Can see BPJS patient reports completely with their SEP number	4	02/11/2014	Pass
3	Can issue document delivery Turn round Time Report	2	02/11/2014	Pass

the needs of users even though it is presented in stages and has a very high success rate.

- Based on its implementations. SCRUM Methodology has the following advantages; being able to adapt in every environment as a whole, regarding flexibility and creativity the methodology team can provide freedom in each iteration and terms of knowledge transfer, dissemination can be done quickly throughout the development journey.
- The quality level of medical record module prototype after being tested using blackbox testing techniques that emphasize the standard dimensions of web application quality such as Content, Function, Structure, Usability, Navigability, Performance, Compatibility, Interoperability, and security can achieve Very Good criteria. Good.

4 WEB APPLICATION TESTING

- Web application content testing to see if there is an error and to look at the console log error in the web browser (Content dimension)
- Compatibility testing in different environments, both operating systems, browsers and different hardware. To test this, what is done is trying to load applications in different browsers and different devices. (Compatibility dimension)
- Testing the security of a web application to find out if there is a gap that can be broken. For this test, application Havij SQL Injection, and Accunetic is used to see if there is a gap that can be bypassed (Security dimension).

5 CONCLUSION

Based on the descriptions in the previous chapters, some conclusions can be conveyed as follows:

- The use of SCRUM methodology for the development of Medical record modules in Siloam Hospital hospitals in TB Simatupang and Bali units is the right step because it can adapt to currently used applications. Also, the ability to capture all the needs of the user and then move them to the application form in stages and can be tested quickly by the user is something that is more valuable than the use of this methodology.
- With SCRUM Methodology the focus of development is no longer on the analysis. However, rather present an application that suits

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