Design of Information System Vaccination Report Data Logging Web-Based Using Waterfall  
(Case Study at Bandung Health Office)

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Abstract

Currently, the field vaccination data reporting activities held by health care facilities in collaboration with Bandung Health Office are still done manually, it results in the process of recording vaccination report data takes a lot of time so that it becomes inefficient and vulnerable to the accumulation of patient data at the time of input of vaccine patient data and it makes the process of activities recording becomes ineffective. The purpose of this study is to create a report data recording information system that can make it easier for vaccination officers to facilitate the input of patient data vaccine and make reports of patient data vaccine and make reports of patient data vaccine with the provision of a print feature of the report as well as the final results of accurate data information. The system is built using Waterfall which this method helps the author in creating system design, design, testing and system implementation. The result of this study is the creation of Web-Based Information System Data Report use Waterfall Method that can be used directly by the health care facility vaccination officer do together with the vaccination officer from the Bandung Health Office at the time of field activities.

Keywords— Data Reports, Software Engineering, Vaccine Covid-19.
1. INTRODUCTION

Coronavirus Disease 2019 (COVID-19) pandemic transmission has occurred all over the world where many countries are affected by the outbreak and exposed to the virus, this has resulted in countries exposed to COVID-19 experiencing enormous losses ranging from economic and social decline. Its rapid transmission also resulted in a large number of people being exposed to the virus and not a few people losing their lives. In Indonesia itself, there are many cases of COVID-19 that make this outbreak must be handled immediately, by seeking restrictions on the transmission of the COVID-19 chain in the midst of community activities, such as the enactment of Large-Scale Social Restriction and the Enforcement of Restriction on Community Activities. This is done by the government to reduce the transmission of the virus that continues to grow every day, but the government feels that this is not enough to be the right solution to overcome the spread of the virus [1]. Therefore, it is necessary to take an action not only in terms of the implementation of health protocols, but also other effective measures needed to break the chain of transmission of COVID-19, through efforts to vaccinate COVID-19 [2]. This effort has been made by various countries including Indonesia. It is to provide an ideal vaccine to improve the immunity of Indonesian people to prevent the spread of the virus, so the government decided to promote the COVID-19 vaccination program in Indonesia. The COVID-19 Vaccination Program in Indonesia is currently being intensively conducted in every region and has been shown to increase people's immunity in the midst of pandemic outbreaks and reduce the number of people exposed to the virus. COVID-19 vaccination aims to break the chain of transmission of COVID-19, lower the rate of pain and death due to COVID-19 and achieve Herd Immunity [1]. Vaccination activities began on January 13, 2021, where the Indonesian government targets vaccinations against approximately 181.55 million people to achieve Herd Immunity for COVID-19 and has been conducted throughout Indonesia, one of which is held in the city of Bandung, West Java [3].

Data and Information is now one of the most important resources and needs to be properly and properly stored and managed. Good data and information processing, can be used to determine the achievement of the success of the service in the government environment. One that can support for this achievement by utilizing reliable data recording and report information [4]. Data recording of reports becomes the basis to support program activities, not only for the needs of the data administration process also meets internal needs but it can be a reference in the decision-making process and service to the community. The ease of access to information has become a necessity for the community to facilitate the work to be more effective and efficient. The development of information systems indirectly related to something that we do will certainly be related to the existence of information systems used, information systems are systems that provide information for decision making or policy where it relates to interactions between people, data, processes, and technology. Data recording and report information is an information system technology that can help people in presenting information and processing quality information data.

Bandung Health Office as a government agency engaged in public health held field activities to provide doses of vaccines to the public gradually. Mass vaccination activities held in the city of Bandung are intended so that the people of Bandung can achieve Herd Immunity, as well as protect the public from COVID-19 in order to remain socially and economically productive. Herd Immunity can only be established if vaccination coverage is high and evenly distributed throughout the region. Prevention efforts through vaccination if assessed from the economic side, will be much more cost-effective when compared to treatment efforts. The development of this information technology can improve performance so that it will eventually increase productivity. This is also applied in vaccination activities so that this activity can be
done quickly, accurate and accurately. Vaccination activities are 3 stages, namely: registration, screening, observation, and after the three stages are carried out, the next activity is recorded COVID-19 patient vaccination data report. The recording is very important so that the vaccination data of COVID-19 patients can be captured and well documented so that the Health officers can analyze and review the data in anticipation in case of discrepancies in patient identity data, patient vaccine dosage data, and historical vaccination data COVID-19 patients who then record this report will be submitted to the Ministry of Health through Health Care Facilities under the auspices of the Bandung Health Office. Currently the Ministry of Health has actually provided a web-based online application (P-Care) as a media for patient registration or a place to record patient data that will be inputted data will be directly recorded in the data base of the ministry of health. But in the use of P-Care application, sometimes there are errors at the time of data input, data entry errors that cause discrepancies in the data of COVID-19 vaccination patients, as well as some health workers who are sometimes still confused and do not understand how to use the P-Care Online application as a reporting application, so that health workers from health care facilities prefer to manually record reports using format standard. The author as one of the students and volunteers of COVID-19 vaccination officers has experienced being one of the few people in charge of the report recording data section[5]. Currently Report logging still uses Manual system using standard formats from Ms.Excel and Google Sheets. But it is considered less effective in terms of time, data storage and data security. From these ineffectiveness, the author aims to create a Web-Based COVID-19 Vaccination Patient Report Data Recording Information System to assist health care facilities in addressing the problem of manual report recording.

2. MATERIAL AND METHODS

In this case the author collects field data that can help the author to conduct this research with the following methods of software development:

2.1 System Development Method

According to Pressman (2015:42), Waterfall Method is a classic model that is systematic, sequential in building software. The name of this model is actually "Linear Sequential Model". This model is often referred to as "classic life cycle" or waterfall method. This model belongs to the generic model of software engineering and was first introduced by Winston Royce around 1970 so it is often considered old-fashioned, but is the most widely used model in software engineering (SE). This model approaches systematically and sequentially. Called waterfall because step by step passed must wait for the completion of the previous stage and run sequentially [6].

The reason the author uses waterfall method is because the process is more structured that keeps the quality of the software maintained, as well as the maintenance process that can be done easily. Because from the user side is more advantaged to be able to plan and prepare the needs of data and processes needed from the beginning then the waterfall development model can run well and without problems.

Here are the step of Waterfall Model according to reference Roger S Pressman (Pressman, 2015:17):

1. Communication (Project Initiation & Requirements Gathering).

   This step is necessary before starting technical work, communication with the user in order to understand and achieve the goals to be achieved. The result of these communications resulted in the initialization of the project, such as analyzing problems and
finding solutions to define software features and functions. Equipped with additional data that can be retrieved in journals, articles, and the internet.

2. Planning (Estimating, Scheduling, Tracking).
   This step explains the estimated technical planning that will be carried out, estimates the risks that will occur, the resources required in the design of the system, the expected final results, as well as supervision and control of work scheduling in the application process.

   This step describes the design and modeling of the system architecture focusing on designing the data structure of the software architecture, the appearance of interface and the algorithm of the program. It is done to understand the big picture of the project to be worked on.

   This step aims to find possible errors in order to be resolved and corrected. In this stage, the translation of design form into code or form/language can be read by the machine. After the coding is complete, testing of the system and the code that has been created.

5. Deployment (Delivery, Support, Feedback)
   This step is the stage of software implementation to users, software maintenance periodically, software repair and evaluation and software development based on the feedback received so that the system can continue to run and develop as expected [6].

2.2. Data Collection Method
   Data collection methods performed by the author to support the work of the report data recording system:
   1. Observation, is a method of data collection conducted by the author by trying to himself become one of the officers / volunteers vaccination part of the report recording, then make direct observations on the object of research, record important things and felt less in the recording of the previous report.
   2. Documentation, is a method of collecting data conducted by the author by collecting data in the form of files related to vaccination.
   3. Interview, is a method of collecting data conducted by the author by conducting a direct interview with the local Health Care Facility and fellow volunteers/officers record vaccination reports in order to get information through the source in more detail and in depth about the problems experienced to be used as a reference for the work of the application.
   4. Reference Study, is a method of data collection conducted by the author by looking for some additional inspiration and references related from articles, journals, and the internet related to research conducted primarily related to the application of report recording.
   5. Questionnaire, is a method of data collection by providing and asking for criticisms and suggestions on system improvements made to some respondents to get input for the development and maintenance of the system [7].

3. RESULT AND DISCUSSION

The process of recording data on ongoing vaccination reports at Health Care Facilities in cooperation with the Bandung Health Office is as follows:
1. Vaccination officer will bring a patient data form paper that has been vaccinated and given to the vaccine data report recording officer.

2. The vaccine data report recording officer then inputs the data listed in the form into Ms. Excell and Google Spreadsheets in the standard format.

3. If the officer has inputted data from the vaccination patient form paper, then separate and then unite the input papers as a sign that the vaccination patient data in the form paper has been inputted in Ms. Excel/Google Spreadsheet.

4. Then, the vaccination officer brings back the inputted vaccination patient data form papers to be captured and archived at the Community Services Facility.

From the flow of the above process, the Author will explain the results of research conducted while being a field officer recording data on vaccination patient reports and explain the analysis of the system to understand the core of the problem by identifying each part or component related to the system, then carried out stages in accordance with the method used waterfall method according to Pressman, as follows:

3.1 Communication (Project Initiation & Requirements Gathering)

To support the success of the information system report recording, this must be followed by an analysis of the needs of the system, among others by identifying every problem in the system, it intends to evaluate and identify problems so as to fix every component of the problem and make any solution that will be fixed in the system. The identification of problems encountered by the author when becoming a data recording officer of vaccination reports as follows:

1. Recording of reports that are still manual.
2. Not efficiency in terms of data recording time used.
3. The level of document security that is vulnerable to data falsification.
4. The effectiveness of data input speed depends on the specifications of the computer used.
5. User who cannot be recognized by the system.

3.2 Planning (Estimating, Scheduling, Tracking)

3.2.1 Running System Analysis

At this stage the author analyzes the system used previously with the system that will be proposed by the author, in order to understand every problems that exist in the previous system, such as manual recording of report data, less efficient in terms of time during the course of report data recording, system security that is vulnerable to duplication, leakage or loss of data, the speed of the input process is influenced by the specifications of the computer device used, and users that the system cannot recognize.

3.2.2 Proposed System Analysis

This system is expected to help the previous system with the online data recording process that utilizes a new web-based report data recording information system, this new system is expected to help improve the performance of officers in recording report data from the current or manual system so that this can be a reference to start recording effectively and efficiently.

3.2.3 System Analysis Required

At this stage explain the analysis of the plan as well as what is required by the system. Analysis of the needs required by the system is as follows:
1) Analysis Admin Needs
   a) Manage Admin Usernames for the security of vaccination patient report data.
   b) Input vaccination patient data.
   c) Change vaccination patient data in case of input errors.
   d) Manage data reports of patients who have already vaccinated.
   e) Print vaccination report recording data [8].

3. 3 Modelling (Analysis & Design)
   The next stage is Modelling, which aims to better understand the cycle of how the big picture of the system is made. At this stage, the author explains the design and architecture of the system as follows.

3. 3.1 UML (Unified Modelling Language)
   According to Martin Fowler (2003), UML (Unified Modelling Language) is a "language" that has become the industry standard for visualizing, designing, and documenting software systems. UML offers a standard for designing a model of a system [9]. Here are the UML diagrams that are usually often used in the development of a system, as follows:

1. Use Case Diagram
   Here is a Use Case Diagram of the report data recording system that describes the login Use Case and Use Case input data registration.
2. **Activity Diagram**
   Here is an Activity Diagram of the report data recording system that describes user login process activity and user validation to enter the system also to report data input activity and report printing process.

3. **Sequence Diagram**
   Here is a Sequence Diagram of the report data recording system that describes the continued sequence of activities Admin login process until the report printing process with a more detailed explanation.

Images 3. Sequence Diagram Login Vaccination Data System.
3. 4 Construction (Code & Test)

3. 4.1 System Implementation

1. Officer Account Register Pages
   Here's a front view of the account list. This feature is intended for vaccination workers who do not have an account to be able to log in and be able to access the system.

![Image 5. Implementation of Officer Account Register.]

Login Pages
Here is the login view, this feature is intended for vaccination officers who are already registered in the user database, who can access to the system.

![Image 6. Implementation of Officer Account Login System.]

2. Dashboard Pages
   Here is the main page view (Dashboard), This feature will display the recapitulation of patient data & record all patient data has been successfully inputted into the vaccine database.

![Image 7. Implementation of The Proposed Vaccination Dashboard System]
3. Registration Pages
   a. Registration of Vaccine Patient Data
      Here is a view of the main page of registration of patient data has been vaccine. This feature is used by officers to register vaccinated patients and display population data information and vaccine status of patients.

   ![Image 8. Implementation of Vaccine Patient Data Registration System](image8)

   Print Vaccination Patient data Report
   Here is a printed view of the patient data registration report. This print feature will display patient data information and vaccine status in pdf format.

   ![Image 9. Implementation of Vaccine Patient Data Report Printing System](image9)

4. Observation Pages
   a. Observation of Vaccine Patient Data
      Here is the main view of the patient data observation page. This feature is a continuation of the registration feature, which here will display the overall information related to patient vaccination data including ticket number data, vaccination patient data, vaccine dose, vaccine type, batch number, serial and location of vaccination implementation.
5. Information Pages
   a. Vaccine Patient Data Information

   Here is the main view of the data information, this additional information data feature will display information data not yet vaccine, and this information has become special point to vaccination officer for decision making.
6. **Black-Box Testing**

a. **Code**

The system is built using PHP programming language, Java, Bootstrap UI and MySQL Database, the system is designed by adjusting the needs of the system, the results of research considerations and suggestions from each user of the system.

b. **Test (Black-Box Test)**

According to Pressman (2005,p551), Black-Box Testing is a testing method that focuses on the functional requirements of the software [6]. According to T.Ostrand (2002) Black-Box trials allow software developers to train all software functionality requirements and tests performed by observing each execution result through test data and checking the functionality of the software[10]. Here's black-box testing on the Login, Registration, Observation, and Information system for recording vaccine report data:

<table>
<thead>
<tr>
<th>No</th>
<th>Scenarios Test</th>
<th>Test Case</th>
<th>Expected Result</th>
<th>Test Result</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Input the registered Username and Password, then press Enter or Login Key to enter the Program.</td>
<td>Username : Admin_vaksin , Password : @Adminvaksin123</td>
<td>System validates Username and Password and successfully displays the main page of the program.</td>
<td>As Expected</td>
<td>Valid</td>
</tr>
<tr>
<td>2</td>
<td>Click the add button and Input Data of vaccine recipients as well as population data of vaccine recipients and then press save button to save data.</td>
<td>-NIK : 327311171197004, -Name : Danila Riyadi, Sex : Female, Age : 19, -Profession : Student, -Vaccine Status : Already Vaccines</td>
<td>The system validates the Recipient Name Input and Population Data data, otherwise the system will reject and if complete the system will pop-up the input data successfully.</td>
<td>As Expected</td>
<td>Valid</td>
</tr>
</tbody>
</table>
3. 5 Deployment (Delivery, Support, Feedback)

The last stage of the waterfall (Deployment) method is system maintenance, the system is required to make improvements and maintenance in order to produce a system that continues to run well, by the way the author does quisioner submissions of criticism and suggestions to the user for the system development process continues periodically.

4. CONCLUSION

Based on the research that has been done, it can be concluded that the implementation of data recording activities of COVID-19 vaccination report at Health Service Facilities in the city of Bandung is still manual, it causes the data recording process will take a long time and result in the recording system becomes ineffective and efficient, then the system is still not optimal and still needs to be developed, based on these considerations, a proposal resulted in web-based report data recording information system, this system is able to improve the security of documents, minimize the redundancy of vaccination patient data and facilitate the recording officer in the process of inputting vaccination patient data so that it is more effective and efficient. The result of the proposed system design has been in accordance with the expectations and functional needs of the system.

5. SUGGESTION

In this Vaccination Report Data Recording Information System, the authors provide some suggestions as a reference for further development for further research, as follows:

1. It is recommended that the socialization of the use of the program against the vaccination officers of health care facilities in the field so that the officers can adapt and simulate the program that will later the experience will help the data input activities and record-keeping
of vaccination patient report data so that it can run smoothly and get the results as expected.
2. Supervise and maintain the system so that the system can develop and run properly as it should.
3. Security system is expected to be updated, this can avoid important data leaks because in this new system, the user can be recognized so that the system can know which users are doing suspicious activities.
4. The result of input data should be in the form of a chart or chart so that it can be used as a reference in effective decision making.

REFERENCES


