

DEVELOPMENT OF VACCINE TRACKING APPLICATION USING AGILE METHODOLOGY

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Abstract

Covid-19 is an infectious disease that has plagued the world since the end of 2019 until now. In Indonesia, the Covid-19 case is quite large, so the government requires everyone to get the vaccine. However, the implementation of the vaccine has not been implemented properly. By taking advantage of the current times, a web-based application was built that can track the circulation of vaccines and contain information about the authenticity of vaccines. The development of this application uses an Agile methodology that focuses on the Extreme Programming (XP) model. Extreme Programming (XP) is a method that can simplify several stages of software development. The results of testing conducted by Blackbox testing show that all existing system feature or functionality have run as expected.

Keywords: Agile, Covid-19, Extreme Programming, Web-based Application, and Vaccine.

Abstrak

Covid-19 merupakan penyakit menular yang menyebar di seluruh dunia sejak akhir tahun 2019 hingga sekarang. Di Indonesia kasus Covid-19 cukup besar, sehingga pemerintah mewajibkan semua orang mendapatkan vaksin. Namun, implementasi vaksin tersebut belum dilaksanakan dengan baik. Dengan memanfaatkan perkembangan zaman, kami membangun sebuah aplikasi berbasis web yang dapat melacak peredaran vaksin dan memuat informasi tentang keaslian data vaksin. Pengembangan aplikasi ini menggunakan metodologi Agile yang berfokus pada model Extreme Programming (XP). Extreme Programming (XP) merupakan sebuah metode yang dapat menyederhanakan beberapa tahap pengembangan perangkat lunak. Hasil pengujian yang dilakukan dengan pengujian Blackbox menunjukkan bahwa semua fitur atau fungsionalitas sistem yang ada telah berjalan sesuai dengan yang diharapkan.

Kata kunci: Agile, Covid-19, Extreme Programming, Aplikasi Berbasis Web, dan Vaksin

1. INTRODUCTION

Covid-19 is an infectious disease that has plagued the world since the end of 2019 [1]. Covid-19 data, in Indonesia at least 6.05 million Covid-19 cases have been recorded. The number recorded is quite large so that the government requires everyone to get the vaccine. Vaccines are antigens (microorganisms) that are inactivated or weakened which when given to a healthy person to cause specific antibodies to these microorganisms, so that when then exposed, will be immune and not affected by disease [2]. In 2022 it has been recorded that the implementation of dose 1 vaccination has reached 92.01%, dose 2 vaccination reached 70.38%, and vaccination 3 as much as 5.51%. Through these data it can be concluded that the implementation of vaccination has not been fully realised. This is due to the rampant issue circulating about vaccines whose authenticity is doubtful. Therefore, a web-based application was built that can track the circulation of vaccines and contain information about the authenticity of vaccines.

Tracking is the activity of tracking the position of the goods being shipped and knowing the progress of the goods. Vaccine tracking is the process of tracking the distribution of vaccines to find out the position of the vaccine being sent. In addition to tracking the distribution of vaccines, vaccine tracking is also used to determine the authenticity of the distributed vaccines [3]. Over time, the use of applications among the public has become more and more popular. An application is a computer program or software designed to perform certain tasks. In the application there are several features that can be used to carry out the functions of the application. Applications are designed by developers to be able to facilitate the work of application users.

Applications can be grouped into three parts, namely desktop applications, web applications, and mobile applications. The focus in this development is web-based applications. The Web is a system related to media for displaying text, images, multimedia, and others on the internet network [4]. Information on the web can be explored and accessed through a web browser. Chrome, Firefox, or Opera are web browser options that can be used to access the web.

It can be concluded that a web-based application is a computer program or software accessed through a web browser. This web-based application can be accessed using a variety of devices without being tied to any time as long as it is connected to the internet network.

The development of this application uses the Agile method. Agile method is a type of short-term system development that requires rapid adaptation and developers must be prepared to changes in any form [5]. This method focuses more on the quality of the applications developed, cost and resource efficiency, and collaboration between teams. The selection of this method is based on application development which is carried out in a short time span and does not require large costs. When compared to the waterfall method, which tends to be done in stages, this agile method is more unstructured, and the development is done little by little. These Agile methods are also responsive to changes that the client wants to make.

2. RESEARCH METHODOLOGY

Agile methodology is a type of short-term system development that requires rapid adaptation and developers must be prepared to changes in any form [5, 8]. This methodology focuses more on the quality of the applications developed, cost and resource efficiency, and collaboration between teams. System development using this methodology is carried out by considering the communication between the developer and the client. Agile methodology consists of several models, such as *Extreme Programming (XP)*, *Adaptive Software Development (ASD)*, *Dynamic Systems Development Method (DSDM)*, *Scrum*, *Crystal*, *Feature Driven Development (FDD)*, and *Agile Modelling (AM)*. However, the model that is more focused in this research is the *Extreme Programming (XP)* model.

Extreme Programming (XP) is a model that can simplify several stages of software development. In this model, coding becomes the focus in the software development stage. The stages in the Extreme Programming model, such as planning, design, coding and testing. Steps of extreme programming are shown in Figure 1.

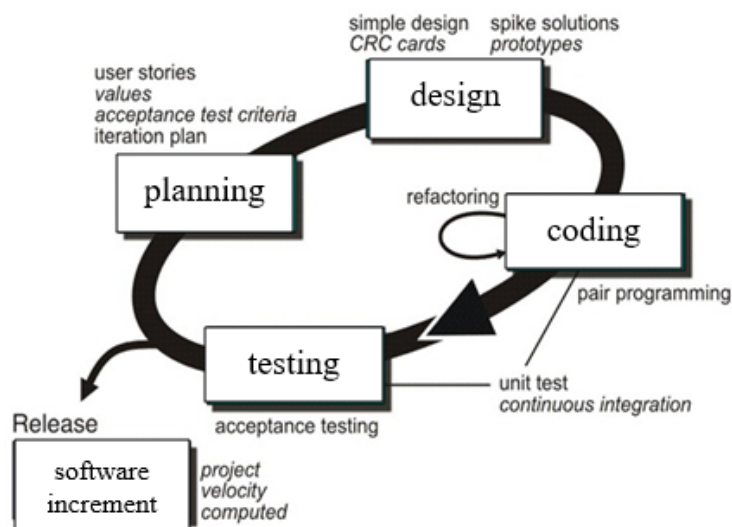


Figure 1. Step of extreme programming [6].

3. RESULT AND DISCUSSION

3.1. Planning

The technology used in the development of this website is as follows.

1. Visual Studio 2022

Visual Studio is an integrated development environment used to modify, test, and run program code. Visual Studio 2022 was released by Microsoft as the first 64-bit studio visual version. The tool supports .Net

6 implementation, IntelliCode AI deployment, and debugging, and allows testing in different environments.

2. SQL Server 2019

SQL Server is a Microsoft relational database management system (RDBMS) software that can be used to manage databases through queries or SQL commands. Microsoft publishes several different editions of SQL Server, aimed at different users and for different workloads from small applications to large applications connected to the internet.

3. C#

C# is an object-oriented programming language from Microsoft that aims to combine the computing power of C++ with the programming ease of Visual Basic [7]. C# is designed to work with Microsoft's .NET platform. C# is one of the most popular programming languages, it is easy to learn and simple to use. C# is used for building mobile applications, desktop applications, web service, and others.

3.2. Design

Design is done before the implementation of the application to be built. Design begins with defining the functional needs from the results of the analysis. The design will describe how the system will be built.

3.2.1. Use Case Diagram

The use case diagram will describe the interaction between one or more actors with the system to be built.

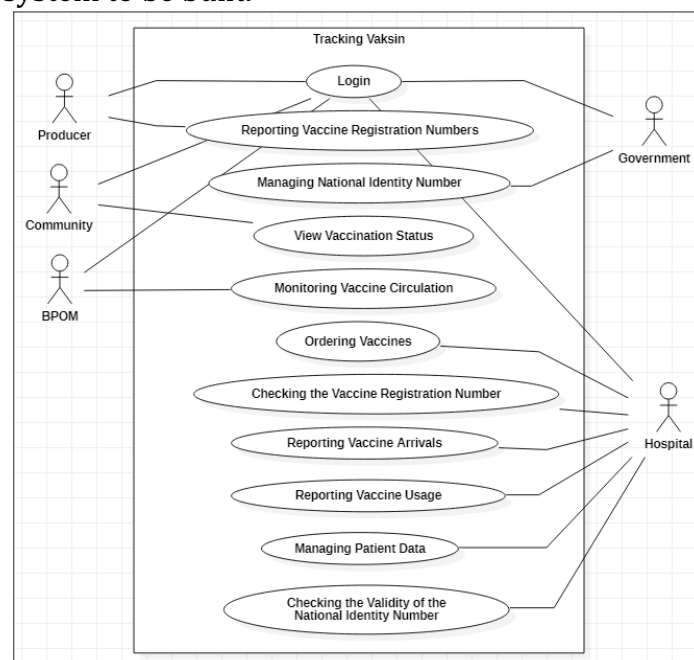


Figure 2. Use case diagram

This web-based application contains several functions which are represented in Figure 2. In this application there are 5 roles, namely Producer,

BPOM, Hospital, Government, and Community. To access the system, all users must login. Producer act as vaccine suppliers as well as report vaccine registration numbers. Hospital orders vaccines from Producer so that vaccines can be distributed to Community. However, before the Hospital receives the vaccine, the vaccine must be registered with BPOM. After that, the Hospital can distribute the vaccine to every Community registered in the Government data.

3.2.2. Physical Data Model

Physical data models describe specific implementations of data model data with databases.

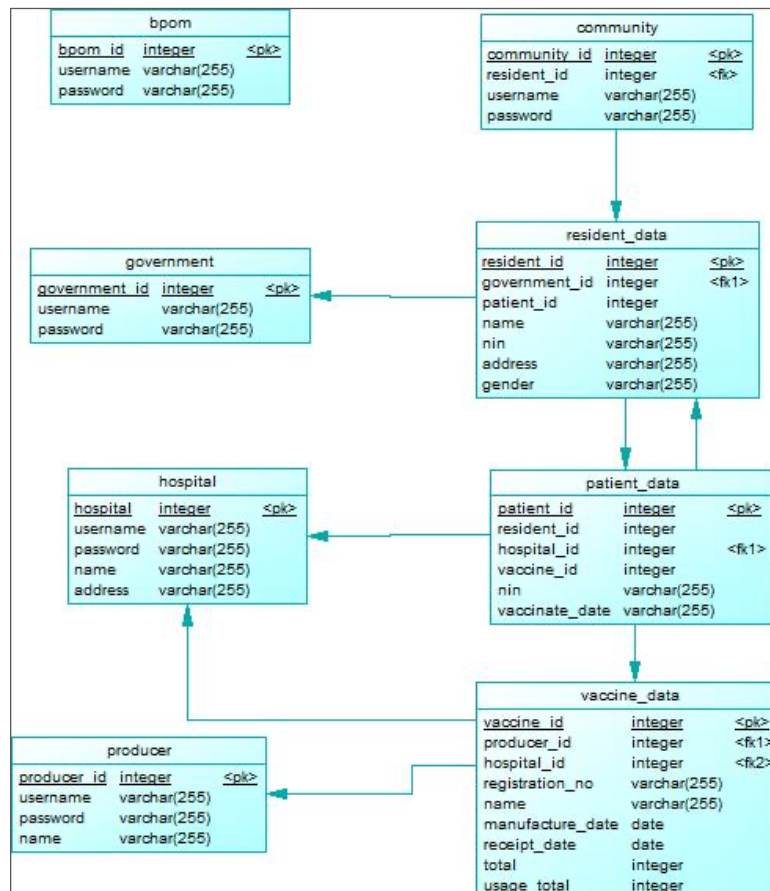


Figure 3. Physical data model

The physical data model is designed according to the database used in this web-based application. In this design there are 8 tables as attached in Figure 3. Each table is related to one another.

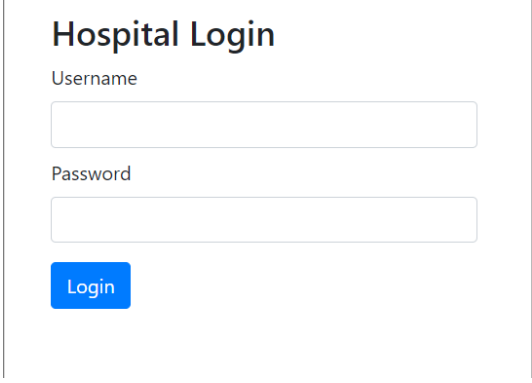
3.2.3. Coding

At the coding stage, coding programs are carried out to build a web application. This web application development uses the C# programming language. WCF is implemented to build a service-oriented vaccine tracking application. In this application, BPOM provides a service that can be accessed by Hospital to

report the arrival of vaccines. In addition, the Government also provides services to be able to check the validity of the Community National Identity Number (NIN).

This vaccine tracking web application applies the MVC concept to the application display design pattern. The results of the coding that have been implemented as a vaccine tracking web application are as follows.

a. Login Interface

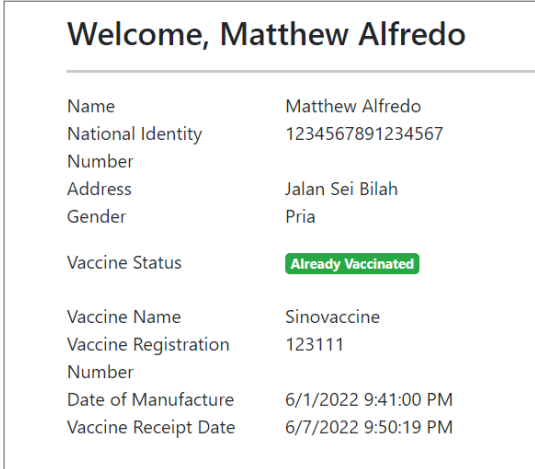


The login interface is titled "Hospital Login". It contains two input fields: "Username" and "Password". Below the password field is a blue "Login" button.

Figure 4. Login Interface

Figure 4 shows the login page to enter the application. This page contains some field, such as username and password.

b. View Vaccination Status Interface



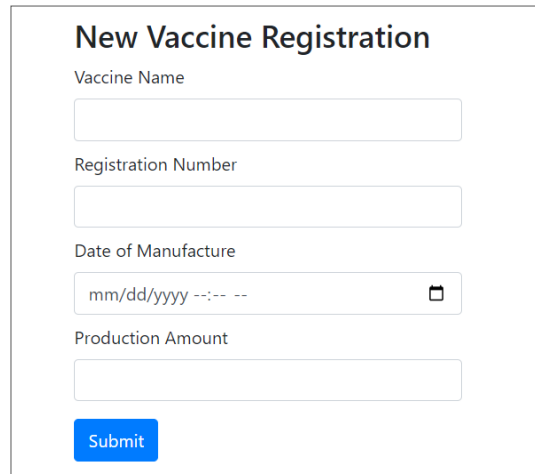
The view vaccination status interface is titled "Welcome, Matthew Alfredo". It displays patient information and vaccination status in a table-like format.

Name	Matthew Alfredo
National Identity Number	1234567891234567
Address	Jalan Sei Bilah
Gender	Pria
Vaccine Status	Already Vaccinated
Vaccine Name	Sinovaccine
Vaccine Registration Number	123111
Date of Manufacture	6/1/2022 9:41:00 PM
Vaccine Receipt Date	6/7/2022 9:50:19 PM

Figure 5. View Vaccination Status Interface

Figure 5 shows the vaccine status page for the patient. This page contains some patient data, such as name, National Identity Number, address, and gender. In addition, on this page there is also some data on vaccines used by patients when they have been vaccinated.

c. Registration Vaccine Interface

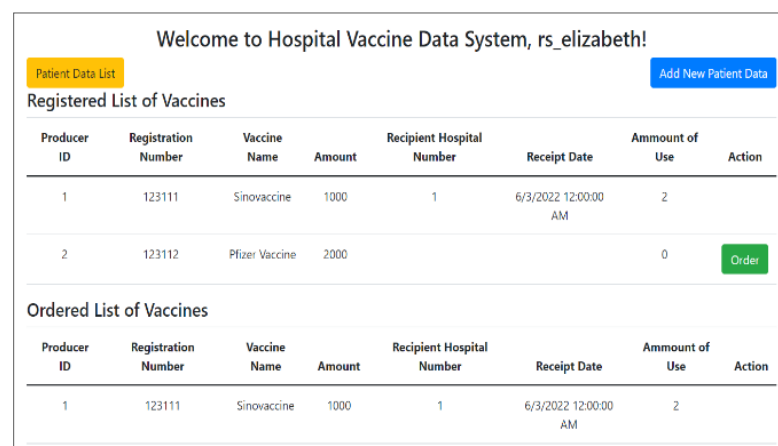


The form is titled "New Vaccine Registration". It contains four input fields: "Vaccine Name", "Registration Number", "Date of Manufacture" (with a date picker icon), and "Production Amount". A blue "Submit" button is located at the bottom.

Figure 6. Registration Vaccine Interface

Figure 6 shows the page for registering a new vaccine. This page contains some field, such as vaccine name, registration number, date of manufacture, and production amount.

d. Vaccination Interface



The interface shows a welcome message "Welcome to Hospital Vaccine Data System, rs_elizabeth!". It has two buttons: "Patient Data List" (yellow) and "Add New Patient Data" (blue). Below is a section titled "Registered List of Vaccines" with a table containing two rows of vaccine data. The first row has an "Order" button. Below this is a section titled "Ordered List of Vaccines" with a table containing one row of vaccine data.

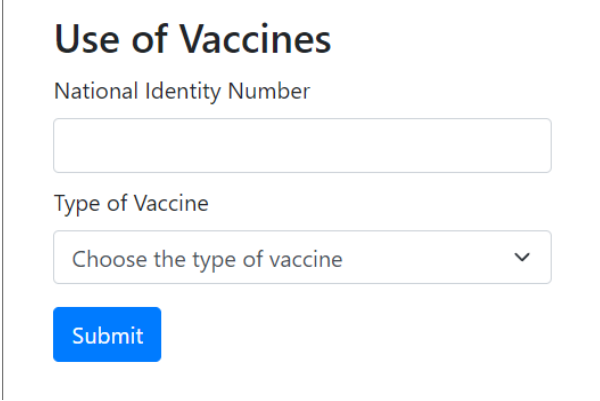
Producer ID	Registration Number	Vaccine Name	Amount	Recipient Hospital Number	Receipt Date	Amount of Use	Action
1	123111	Sinovaccine	1000	1	6/3/2022 12:00:00 AM	2	
2	123112	Pfizer Vaccine	2000			0	Order

Producer ID	Registration Number	Vaccine Name	Amount	Recipient Hospital Number	Receipt Date	Amount of Use	Action
1	123111	Sinovaccine	1000	1	6/3/2022 12:00:00 AM	2	

Figure 7. Vaccination Interface

Figure 7 shows a page used by the hospital for ordering vaccines, reporting information on vaccine arrivals and checking the registration number.

e. Usage Reporting Interface

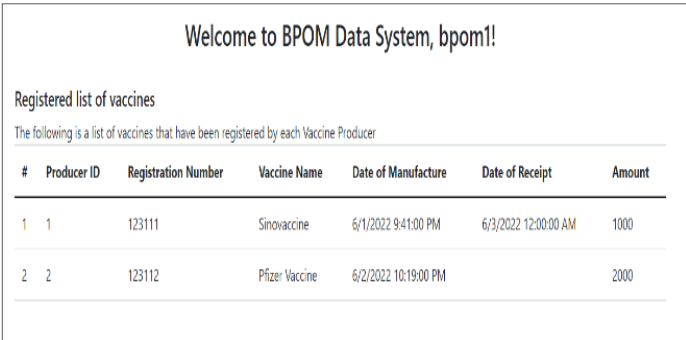


The form titled "Use of Vaccines" contains a text input field for "National Identity Number", a dropdown menu for "Type of Vaccine" with the placeholder text "Choose the type of vaccine", and a blue "Submit" button.

Figure 8. Usage Reporting Interface

Figure 8 shows a page for reporting vaccine usage based on patient data by a hospital. This page contains several fields, such as National Identity Number and vaccine name.

f. Monitoring Vaccine Circulation Interface



Welcome to BPOM Data System, bpm1!

Registered list of vaccines

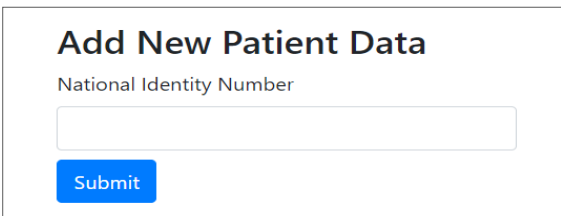
The following is a list of vaccines that have been registered by each Vaccine Producer

#	Producer ID	Registration Number	Vaccine Name	Date of Manufacture	Date of Receipt	Amount
1	1	123111	Sinovaccine	6/1/2022 9:41:00 PM	6/3/2022 12:00:00 AM	1000
2	2	123112	Pfizer Vaccine	6/2/2022 10:19:00 PM		2000

Figure 1. Monitoring Vaccine Circulation Interface.

Figure 9 shows the page used by BPOM to monitor vaccine circulation. This page contains data on vaccines that have been circulated to hospitals

g. Managing patient data interface



The form titled "Add New Patient Data" contains a text input field for "National Identity Number" and a blue "Submit" button.

Figure 2. Managing patient data interface.

Figure 10 shows the page used by hospital for adding patient data. Data addition is done based on National Identity Number.

h. Managing National Identity Number Interface

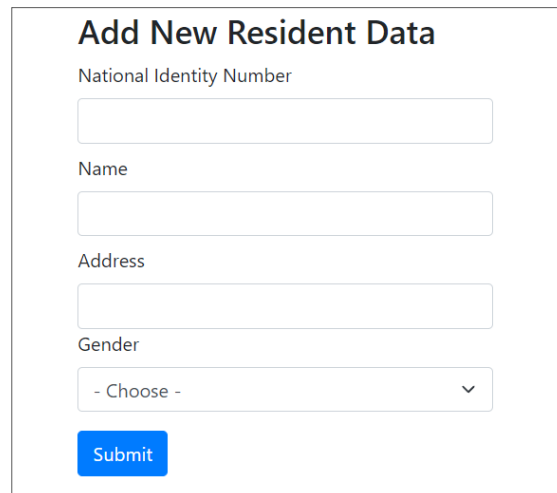


Figure 11. Managing National Identity Number Interface.

Figure 11 shows the page used by the government for adding resident data. The data added is National Identity Number, name, address, and gender.

3.2.4. Physical Data Model

The testing stage is carried out by testing the applications that have been developed. Testing this application is done using Blackbox testing. Therefore, testing is enough to test the functionality of the application to find out whether it is running according to planning or not. The results of testing the functions on the application are attached in Table 1.

Table 1
Functional Testing

Function	Expected Result	Actual Result
Login	Login Interface	OK
View Vaccination Status	View Vaccination Status Interface	OK
Reporting Vaccine Registration Numbers	Registration Vaccine Interface	OK
Ordering Vaccines	Vaccination Interface	OK
Checking the Vaccine Registration Number	Vaccination Interface	OK
Reporting Vaccine	Vaccination	OK

Function	Expected Result	Actual Result
Arrivals	Interface	OK
Reporting Vaccine Usage	Usage Reporting Interface	
Monitoring Vaccine Circulation	Monitoring Vaccine Circulation Interface	
Checking the Validity of the National Identity Number	Managing Patient Data Interface	OK
Managing Patient Data	Managing Patient Data Interface	OK
Managing National Identity Number	Managing National Identity Number Interface	OK

4. CONCLUSION

From the results of this website-based application development, it can be concluded that:

- The Vaccine Tracking application is built based on the many issues circulating about vaccines of doubtful authenticity.
- The design of this Vaccine Tracking application uses the Agile Process approach with the Extreme Programming model to make the application creation process faster.
- The results of tests carried out using Blackbox testing indicate that all features or functionality of the existing system are running as expected.

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