

## DESIGNING THE MODEL OF ONLINE IMMUNIZATION RECORD SYSTEM

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### ABSTRACT

Immunization is an effort made to prevent the occurrence of a disease by inserting a weak antigen into the body of the child, so as to stimulate antibodies against the antigen types in the future. In this study, the immunization system was developed to help mothers receive the right immunization for their child in the right time, with digital processes that exists before such as child registration, dissemination availability of vaccine, and immunization booking. This system also reminds the mothers to give immunization to their child via text message that sent to the mother's cell phone. Besides that, this system can inform the clinics to provide such amount of vaccine needed for a certain period of time. This research aims to improve the completeness of immunization, especially Complete Basic Immunization in Indonesia by using Rapid Application Technology (RAD) as the development method, and online web based application to improve its accessibility from the users, such as the administrator of the clinics and the mothers can access this system everywhere, if their place has internet access.

**KEYWORDS:** Immunization, Online System, System Design

### INTRODUCTION

Immunizations can be given to all ages, but will have a more optimal effect when given at certain ages, particularly at age 0 to 18 months. Currently in Indonesia, there are 6 types of immunizations required by the government, such as Bacillus Calmette-Guerin (BCG), Polio, Diphtheria-Pertussis-Tetanus (DPT), measles, hepatitis B, and Haemophilus influenzae type b (Hib). Although required by the government, but the basic immunization coverage in Indonesia has reached 86.8% and is targeted to reach 93% in 2019. Some of the things that cause the lack of dissemination of basic immunization is the availability of vaccines, the lack of knowledge of the mother, and the difficulty of access to the place health services [1]. In order to help increase the deployment of basic immunization, this study [2] develops a web-based immunization system by the method of Rapid Application Development (RAD) which can help remind mothers to bring their children for immunization. Therefore, all children can get immunized on time. In addition, this system also has booking feature a vaccine that can help disseminate information about the availability of the vaccine among health care providers with the mothers. Through vaccine booking features found on these systems, the provider of vaccines also can estimate the number and type of vaccine, needed at a particular period. This system will be implemented in clinics that serves immunization vaccine from baby to an adult.

### PROBLEM DEFINITION AND PROBLEM SOLVING METHOD

#### Problem Definition

The clinics are located in Tangerang, Indonesia, which serves Immunization Vaccines complete basis for the toddlers to adult immunization. In performing its duties, most of the clinics use a card, that was filled manually to record data and

immunization of children already and need to be taken earlier. This is a challenge, because the card is held by mothers are often missing, so the clinic just asks the mother about immunization that has been taken based on the child's age. In this study, immunization system will be developed, which can help the mothers to remember the immunization schedule and type of immunization will be taken through a short message service (SMS) sent to the mother's mobile phone number. In addition, the system is also able to help the clinics to prepare the vaccine is needed at a particular time, and also the mother and the clinics can determine what immunizations are already taken by the child?

Research accomplished, use of short messaging services to assist adherence to treatment that had been tested in several countries, with people of middle and have a significant positive effect in improving the timeliness of their treatment. One study conducted in Peru that uses SMS to remind the schedule of Tuberculosis patients who are routinely treated. From this research result, it is understandable that the use of SMS can be an efficient way to deliver health information and schedule of treatment [5]. Similar research has also been carried out, and this system provides a lot of convenience for IHC to spread the immunization schedule will take place. This system received a positive response, because, before that not have its own way to spread the childhood immunization schedule [7].

### **Problem Solving Method**

The method used in this study is a Rapid Application Development, as a method of making a system that consists of four stages: Requirement Analysis, User Design, Construction, and Cutover [3, 8].

### **Requirement Analysis**

At this stage, interviews to the doctors in charge of the clinics to determine what features should be present on the system that will be made so as to have an optimal impact, such as: the difficulties faced in terms of procedures, ranging from immunization agreement (booking), to the immunization schedule. Also to gather more data, distribute questionnaires to 50 mothers who bring their children to the clinics was doing at this stage to know the difficulties often faced by mothers.

### **User Design**

In this step, UML is used to visualize the logic of the system being designed [6]. The end result of UML will be used to make the system at a later stage, namely Construction.

### **Construction**

In Construction phase, the visualization system that was made before using the PHP programming language and MySQL database. Making the system using CodeIgniter framework 2.1.4 so that the system created patterned Model-View-Controller (MVC Pattern) so that its programming is Object-Oriented Programming (OOP).

### **Cutover**

This phase is the last stage where the system already created and ready to be implemented in the clinics which located in Tangerang, Indonesia.

## **ANALYSIS AND RESULT**

After the interview process, there are three things that could be added in the key features of this study. The first is the difficulty of recording data for the recording is done using a child's immunization card held by the mother. This immunization card containing data of children from the child's name, child's date of birth, parent information, and schedule of immunization

needs to be taken further. Recording data using immunization cards often creates difficulties because the card is lost or damaged, so the house Vaccine difficult to know what immunizations are already taken by the child. In addition, if the immunization card is not carried by the mother when to bring their children for immunization, the vaccine House needs to issue a new card that does not have complete data on child immunization had been taken.

The second difficulty was the complexity of the process of dissemination of information regarding the availability of the vaccine. Dissemination of this information is already using social media and instant messaging applications (Instant Messaging). The importance of the availability of information relating to the booking process vaccine immunization. Booking process has been done manually by phone and instant messaging applications rated difficult for the administrators, clinic because the clinic administrator must check the availability of vaccines in advance of any request to ensure that the vaccines requested is available.

The third difficulty concerning the preparation of the number of vaccines need to be prepared within a certain period. For example, the clinics do not have a particular method to determine the amount of vaccine, which needed for patients that already recorded on the immunization card held by his mother, so that the process of preparation of stock immunization only based on estimates and the number of vaccines available on the market only. In addition, many types of vaccine stock a certain amount is limited in the market so many clinics and hospitals experienced vacancies in certain types of vaccine stocks. Based on the questioners said that, as many as 50% of all respondents claimed to have delay immunization. The reason is variable, such as: the sick child (36%), forgetting the immunization schedule (27%), a doctor who is not in place (18%), vaccines that are vacant (14%), and the immunization schedule collided with the holiday schedule with his father and mother. The 96% of all respondents said that would be helped if there is a system that can help remind the child immunization schedule.

Therefore, based on the result of the interview and questioner, there are seven key features in the system that added into this system as follows:

- User friendly for users to access the system, in this case the mothers.
- The login and user management features to protect the system from unauthorized access (unauthorized access).
- Features stock management to display the number of vaccines available at the clinic. The clinic can manage information about the availability of vaccine that can be seen by the mother.
- Features for immunization of mothers make a booking online. The process of booking can be done if a vaccine is available and immunization date is imminent.
- Features to disseminate information to the mother her child immunization schedule via SMS either already make bookings, or not.
- Features to know what immunizations are already taken by the child, and subsequent immunizations that need to be taken by his son.
- Features stock projection for the clinic, so the clinic can determine the number and type of vaccine is needed at a particular period.
- Features to perform data recording immunizing children when the mother came to the clinic either already make the process of booking or not.

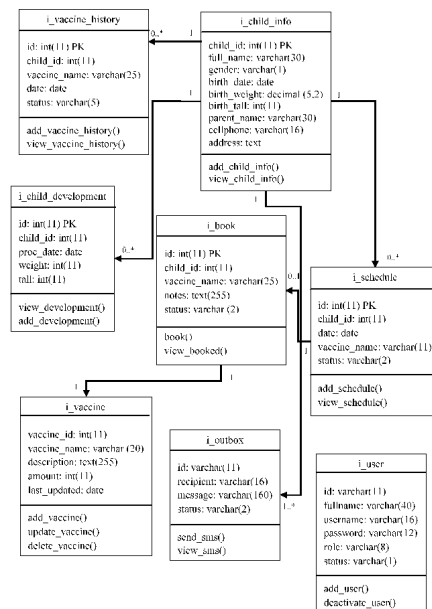
During the design process, the visualization system using UML based on the [4] and consisting of two actors and five use cases:

**Actors**

The first actor is the mother of the child to be immunized. Every mother and child who are enrolled in the system can make the process of booking immunization (use case Make a Promise Immunization), which refers to the availability of stocks of vaccines and immunization dates. In addition, the mother can see her child immunization data (use case View Childhood Immunization Data) to determine what immunizations are already and have not been taken up by his son, whether mandatory or not mandatory immunization. The second actor is the administrator of the clinic board. Administrators can set up information about the availability of certain types of vaccines in the clinic so that the mothers can make the process of booking (use case Set Stock Vaccine).

**Process**

The use case Add Data Child Immunization, clinic administrator can record data of child immunization, whether registered or not and record the data of children who are not registered into the system of immunization. Then in the use case Send SMS, clinic administrator can view the SMS reminder will be sent and if it is less, then the administrator can create a specific message to mothers who are already registered in the system. To note, this SMS delivery is one-way, so that the mother cannot reply to messages sent. A. Construction of this section of the display shows the immunization system that has been created based on the stage of requirements analysis and user design has been done before. This application has two types of views, the views to the clinic administrator and pages that can be accessed by the mother.



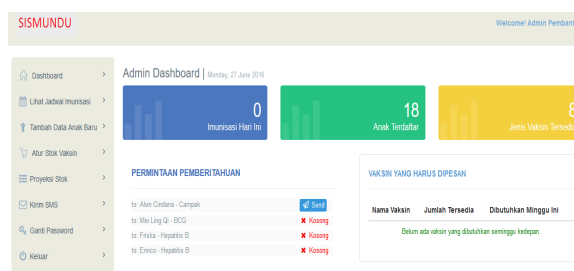
**Figure 1: Class Diagram**

In Figure 1 can be seen the Class Diagram which describes the Class Diagram that contains the tables needed to store data in the database. All table names have an 'i\_' alias at the beginning of the table name to help prevent SQL injection attacks in the system later. The application was developed using Indonesian language to make all the users easier to understand.



**Figure 2: Login Page**

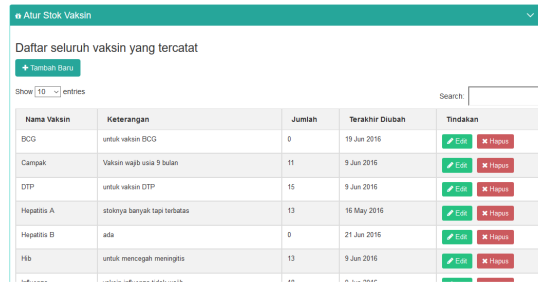
Figure 2 is an initial display page immunization system that requires authorized access. Mothers who already have an account can login by entering a phone number that is already registered by the date of his birth as his password with ddmmyyyy format making it easier for moms to remember the immunization system account. For security reasons, mothers can change their account password later on. Administrator clinics also perform the login process on the same page with the mother login page. However, the clinic administrator account has a structure different from the account of the mother, and the validation process is done automatically on the server side.



**Figure 3: Dashboard Admin**

On the page admin dashboard, there are 5 menus that can be accessed by the administrator, the Dashboard, View Immunization Schedule, Vaccine Stock Set, Projection Stock, Send SMS. Each menu has a different function and will be further described in these below:

- The dashboard Admin page will be appearing when the clinic administrator if successfully logged in. The system will redirect to the administrator dashboard page as shown in figure 3. At the top of the dashboard, there are three banners which briefly describe the state of the clinic of the number of immunizations will be done today (banner blue), the number of children enrolled in the clinic (banner green), and the number of vaccines available at the clinic (banner yellow). Under the banner there are three large panels containing two brief info about the notification request the vaccine was empty, and the stock of vaccines that need to be booked during the week.
- Page Set Stock Vaccine is to organize information on the type and amount of vaccine available, the administrator needs to access the page Vaccine Stock Set from the main menu to appear as in Figure 4.



Atur Stok Vaksin

Daftar seluruh vaksin yang tercatat

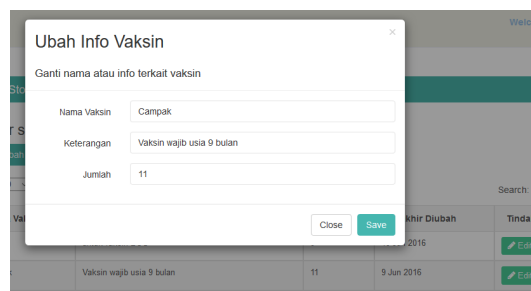
+ Tambah Baru

Show 10 entries

Nama Vaksin	Keterangan	Jumlah	Terakhir Diubah	Tindakan
BCG	untuk vaksin BCG	0	19 Jun 2016	<a href="#">Edit</a> <a href="#">Hapus</a>
Campak	Vaksin wajib usia 9 bulan	11	9 Jun 2016	<a href="#">Edit</a> <a href="#">Hapus</a>
DTP	untuk vaksin DTP	15	9 Jun 2016	<a href="#">Edit</a> <a href="#">Hapus</a>
Hepatitis A	stolonya banyak tapi terbatas	13	16 May 2016	<a href="#">Edit</a> <a href="#">Hapus</a>
Hepatitis B	ada	0	21 Jun 2016	<a href="#">Edit</a> <a href="#">Hapus</a>
Hib	untuk mencegah meningitis	13	9 Jun 2016	<a href="#">Edit</a> <a href="#">Hapus</a>

Figure 4: Stock Page

From page to set the initial vaccine, the administrator can see the number and types of vaccine available in the clinic. If the clinic has information about the new vaccine stock, the admins need to click the edit button on the line of vaccines intended to display a dialog box as in Figure 5.



Ubah Info Vaksin

Ganti nama atau info terkait vaksin

Nama Vaksin: Campak

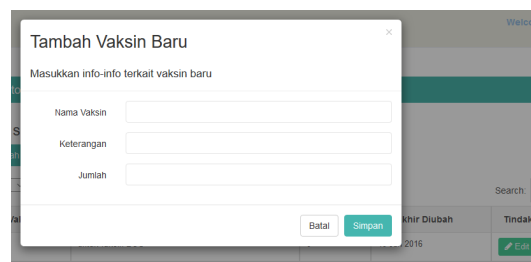
Keterangan: Vaksin wajib usia 9 bulan

Jumlah: 11

Close Save

Figure 5: Vaccine Information

After the dialog box appears, the admin simply needs to fill in the amount and type of the vaccine. If one day the clinic has a new type of vaccine, then the administrator needs to register the new vaccines through the Add New button to display a dialog box as shown in Figure 6. When administrators have finished completing the data on new vaccines, so administrators only need to click the save button, so that the new data stored in the database and instantly appears on the page Adjust Stock Vaccine.



Tambah Vaksin Baru

Masukkan info-info terkait vaksin baru

Nama Vaksin:

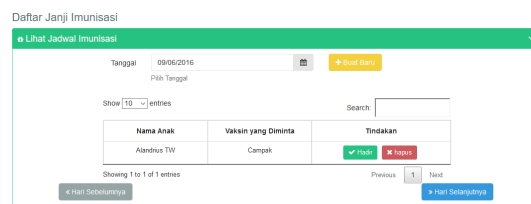
Keterangan:

Jumlah:

Batal Simpan

Figure 6: Added Vaccine

- The immunization Schedule page serves for administrators see a list of immunization agreement that has been recorded in the system. Administrators can access this page from the View Menu Immunization Schedule shown in Figure 7.



Daftar Janji Imunisasi

Lihat Jadwal Imunisasi

Tanggal: 09/06/2016

Pilih Tanggal

+ Tambah Baru

Show 10 entries

Nama Anak	Vaksin yang Diminta	Tindakan
Abdus TW	Campak	<a href="#">Edit</a> <a href="#">Hapus</a>

Showing 1 to 1 of 1 entries

Previous 1 Next

Hasil Sebelumnya Hasil Selanjutnya

Figure 7: Appointment of Immunization

The system displays a list of booking immunization by date selected by the user, in this case the administrator. Admin need to click a button, when the mother and child arrives for which data are already registered, so that the child immunization data will appear. But if the mother and child immunization is not forthcoming, then the admin can cancel the booking of the list via the Delete button. If at any time there are mothers who come to bring the child immunization without going through the booking process, then administrators need to check in advance whether the child has been registered. If not registered, then the mother should do the registration process carried out also by admin. Then after registering, the administrator needs to check the availability of the requested vaccine. If the vaccine is available, then the child can be directly immunized with the click of a button “Create a new immunization”

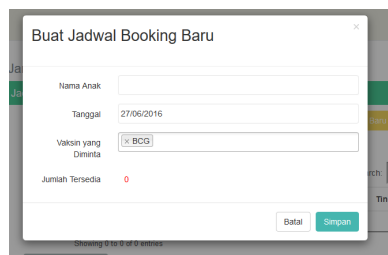


Figure 8: Added Appointment of Immunization

- Projection Stock Page has a function to determine the amount of vaccine needed at a particular time period described in Figure 9. This page can only be accessed by the administrator from the menu Projection Stock clinic.

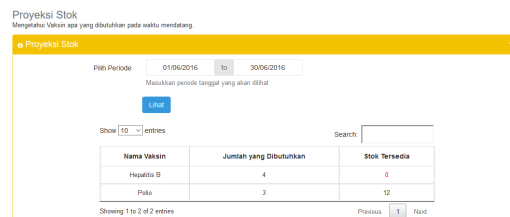


Figure 9: Projection Stock

The projection Stock page displays the number and types of vaccine needed by the clinic and its comparison with the stock available at the clinic. If the stock is less than required, then the system will bring up the red text to prevent a void vaccine. Users can change the forecast period the stock so that it can determine the vaccine needs up to several months.

- Send SMS Page was built to send a reminder message by using SMS to the mother, the system requires an administrator's approval to send SMS so that SMS messages sent are not intrusive if administrators feel the SMS does not need to be sent. SMS sends pages can be accessed through the menu Send SMS from the main menu to appear like the Figure 10.

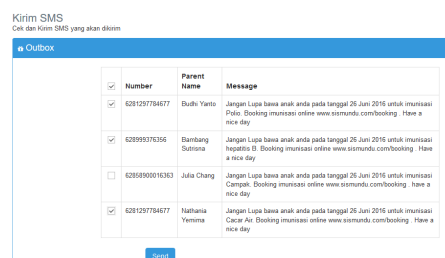


Figure 10: Send SMS

From this page, the administrator can choose the SMS to be sent by clicking the checkbox located on the left side of the table, so as to facilitate the delivery process. In addition, there is also a checkbox column, columns destination number, parents' names, and the content of the message to be sent. After selecting the SMS to be sent, administrators only need to press the Send button located under the table. The immunization system to send SMS via Application Programming Interface raja-sms.com which is a paid SMS gateway provider where the user via a PHP script to send credential form of user ID, password, API Key, destination number, and the message will be sent. Furthermore, through the features found in PHP, CURL, the system will send the required information to the API raja-sms.com to be processed so that SMS can be up to a number of destinations. SMS delivery using a random number and is one-way, so that the recipient cannot reply to messages sent.

In the immunization system mothers also can login to the system and on page mother dashboards, there are 2 main menus that can be accessed by the administrator Mother home page, Immunization Type and Immunization Booking.

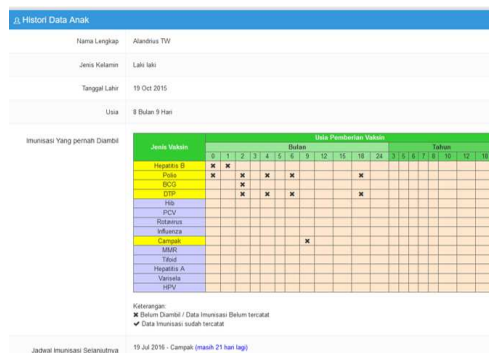
- Mother Dashboard will be appearing when she successfully logged in, the mother will be redirected to the Home page that looks like shown in the figure 11.



**Figure 11: Mother Home Page**

In Figure 11, there are three parts, namely a, b, and c. In section A, there are some menus that can be accessed by mothers, namely the Home menu, Data Immunization, Vaccine Stock View, Change Password and Logout to exit the system. Part B consists of three banners, namely a blue banner that contains information about the time of the next immunization, green banner contains information on the number of immunizations already taken, and the yellow banner that contains information about the number of immunizations are still required to be taken. In Section C there are two panels containing two charts, the charts the development of the child's weight and height development of children. Children's weight and height data obtained each time the child comes into the clinic for immunization.

- The immunization Type page contains information about the data and immunization of children who have been taken by the child. This page shows in figure 12.



**Figure 12: Type of Immunization**



This page contains basic information and data mandatory immunization of children who have or have not been taken. If the date is in the past immunization, maternal immunization can still make bookings if the stock is available.

- The immunization Booking page is a page that is used by the mother to make the booking process. Booking can only be processed if the date immunizations are within less than 7 days. The process of calculating the date performed on the server so as to minimize the difference in the date of access. In addition, this booking page also shows the type of immunization and vaccines are available. If the requested vaccine was not available, then the writing will be red and the booking process cannot be done. Booking page views that can be in the process shown in Figure 13.

**Figure 13: Booking of Immunization**

On this page, mothers can choose the date of the visit is available, then the type of vaccine that will be taken, and selection and their suggested amount of vaccine available.

## CONCLUSIONS

The immune system was developed which can help mothers to get proper immunization in terms of time and type of immunization through SMS sending feature to remind the immunization schedule and immunization online booking features. The system can determine the number and type of vaccine needed for a certain period, so that it can prevent a vacuum in vaccines in the clinic. In the future research, additional features can be added such as the two-way SMS features, where the mother can make bookings only through “SMS reply” that reminds immunization.

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