

# Implementation of Golang and ReactJS in the COVID-19 Vaccination Reservation System

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## Abstract

*SARS-COV-2, or COVID-19, has become a global threat. Since it was determined to become a pandemic status in Indonesia, various efforts have been taken by the government, one of which is the mass vaccination program. After going through a long journey to test its effectiveness, quality and safety through various stages of research and trials, the COVID-19 vaccine is officially distributed to the public. The vaccination program is critical to combating the COVID-19 pandemic since it can reduce morbidity and mortality rates and supports achieving herd immunity against the COVID-19 virus. During the mass vaccination process, queues and crowds are often encountered, which can potentially increase the spread of the COVID-19 virus. This research aims to anticipate the risk of transmission in the vaccination process by building a vaccination reservation system. This system is built by implementing two leading technologies: the Go programming language (Golang) and JavaScript with the ReactJS library.*

*Keywords: COVID-19, Vaccination, Rreservation System, Golang, ReactJS*



## 1. Introduction

Since the first case was reported in Indonesia in March 2020, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS CoV 2), better known as COVID-19, has created an emergency status in Indonesia[1]. As of 08 August 2022, it was recorded that at least 6,235,244 positive confirmed cases of COVID-19 in Indonesia had claimed 157,072 lives[2]. Various efforts have been made to overcome the impact of COVID-19, one of which is implementing a vaccination program[3]. Giving vaccines is one of the efforts that is considered the most effective in fighting the ongoing COVID-19 pandemic[4].

The advanced stage of COVID-19 vaccination or booster vaccination is a vaccination obtained after a person has received a total dose of primary vaccination (vaccination 1 & 2). The aim of holding booster vaccinations is to maintain the level of immunity against the COVID-19 virus and extend the protection period of the primary vaccine[5]. As noted from the covid19.go.id page, booster vaccinations are essential in reducing the morbidity and mortality of COVID-19 patients. So, in this case, the government invites the public to work together for the success of the vaccination program, which continues to be boosted; this is shown in the significantly increased coverage of booster vaccinations[6]. The follow-up vaccination target in Indonesia was recorded as 14 November 2022 at 67,078,071 doses, or around 28% of the target[7]. The enthusiasm of the people in receiving the follow-up vaccine was outstanding, but reflecting on the previous phases 1 and 2 of the vaccination program, it was found that the mass vaccination program could also cause crowds and quite long queues, one of which was the participant registration counter[8]. This crowd has the potential to cause the spread of COVID-19 to get worse. Research states that SARS-Cov-2 (COVID-19) can spread through aerosols after exposure for 3 hours; this needs to be anticipated so that this vaccination program does not become a medium for increasing the spread of the virus[9].

Several studies have been conducted to answer similar problems, such as in research producing applications that do not require COVID-19 patients to come to the hospital to register but can be done online to minimize transmission of the COVID-19 chain[10]. The resulting application also has a role in making it easier for the hospital to manage reservation data. Other relevant research with the Juanda Hospital case study resulted in an information system for scheduling and reservation services for doctors at Juanda Hospital, which makes it easier for patients and hospital administrative staff to process reservation files[11].

Based on the description of the problems that have been described in helping the government increase the coverage of advanced vaccines in achieving the national vaccination target, this research will build a COVID-19 vaccination reservation system[12]. The system output is a website platform that acts as a third party in vaccination reservations so that the public can make reservations for vaccination sessions online at any time. The system is implemented using the Golang programming language on the server side (backend) and JavaScript using the ReactJS library on the client side (front end)[13]. The Database Management System (DBMS), which is used as data storage media on the system, is MySQL. This system can be divided into three accesses, namely system administrators, officers, and the public, each of whom has access and privileges[14]. The system administrator owns full system access rights. Officers have access to manage data on the vaccination program implementation according to what is registered[15]. At the same time, the community has access to registration and enrollment in the vaccination program is held for the renewal of the two previous studies, such as the scope of research where in this study, the system acts as a third party for organizing reservations, as well as the difference in the features provided, namely, in this system a feature is available to display the closest vaccination location from the participant's position[16]. With this system, it is hoped that it can assist government programs in increasing the coverage of COVID-19 vaccinations by reducing the risk of transmission[17].

## 2. Research Method

This research was conducted by going through several stages. This stage starts from data collection, system analysis and design, system implementation and testing with the flow as shown in Figure 1 below:

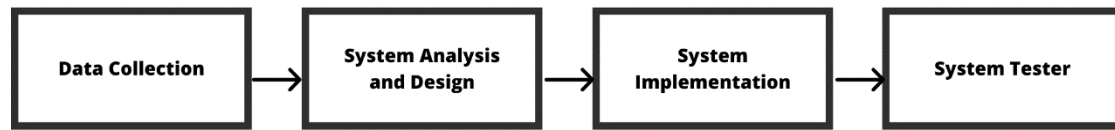


Figure 1. Research method

## 2.1 Literature Review

### A. Application Programming Interface (API)

API is an interface or interface consisting of many instructions arranged in a library or library. In general, APIs expose a series of data and functions that facilitate software to exchange information with other software. Web API has several architectural styles, one of which is REST. Representational State Transfer (REST) is the fruit of the work of Roy T. Fielding in his dissertation entitled "Architectural Styles and the Design of Network-based Software Architectures" in 2000. The REST architectural style eventually became popular and became one of the most commonly used architectures on the web—modern services.

### B. Go

Go Programming Language Go Programming Language or often also called Golang, is an open-source programming language with a syntactic style similar to the C and C ++ languages released by Google. The language designed by 3 Google Computer Scientists, Robert Griesemer, Ken Thompson, and Rob Pike, was initially designed to address memory leaks which had been a longstanding obstacle to the C++ language. Officially introduced to the public in 2009, Go provides several excellent features: it's simple, so it's easy to learn; syntactically lightweight and good memory management; fast compilation process; imperative (structural and procedural) that supports concurrency; the existence of static typing which makes Go a safe programming language; free and open-source with complete documentation; and supports cross-compilation (cross-resource compilation).

### C. ReactJS

ReactJS is a JavaScript programming language interface library or library developed by Facebook and released in 2013. ReactJS is equipped with several advantages such as: easy to learn with complete documentation support; the existence of JSX, which makes it easy to combine HTML with Javascript in one file; Component reusability (components can be reused in other applications with the same function); using Virtual DOM so that the rendering process is faster; SEO (Search Engine Optimization) friendly, making it easy for search engines to find; and React provides the React Development Tool which is a browser extension like Chrome and Mozilla Firefox, making it easier for developers in the debugging process.

## 3. Results and Discussion

### A. System Requirement Specifications

Based on the results of the analysis and data collection, a requirement specification for the vaccination reservation system can be designed, which can be found in Table 1 below:

Table 1. System Requirements Specifications

No	Role	Requirement Specifications
1	Community (vaccination participants)	Users can register accounts
		Users can see the nearest vaccination location
		Users can register family members
		Users can register for available vaccination session
		Users can see proof of vaccination registration tickets
		Users can manage profiles

2	Admin	Users can manage health facility data
		Users can manage vaccine data
		Users can manage vaccination session data
		Users can manage data on vaccination participants

### B. Entity Relationship Diagram (ERD)

ERD is a diagram that conceptually (abstraction) models the data structure in the system by describing entities and their relationships (relationships) between them[18]. Conceptually, the data in the system is categorized into seven entities: admin entities, vaccines, current addresses, citizens, sessions, health facilities and bookings[19]. Figure 2 below shows the results of database entity analysis using ERD using Crow's Foot notation.

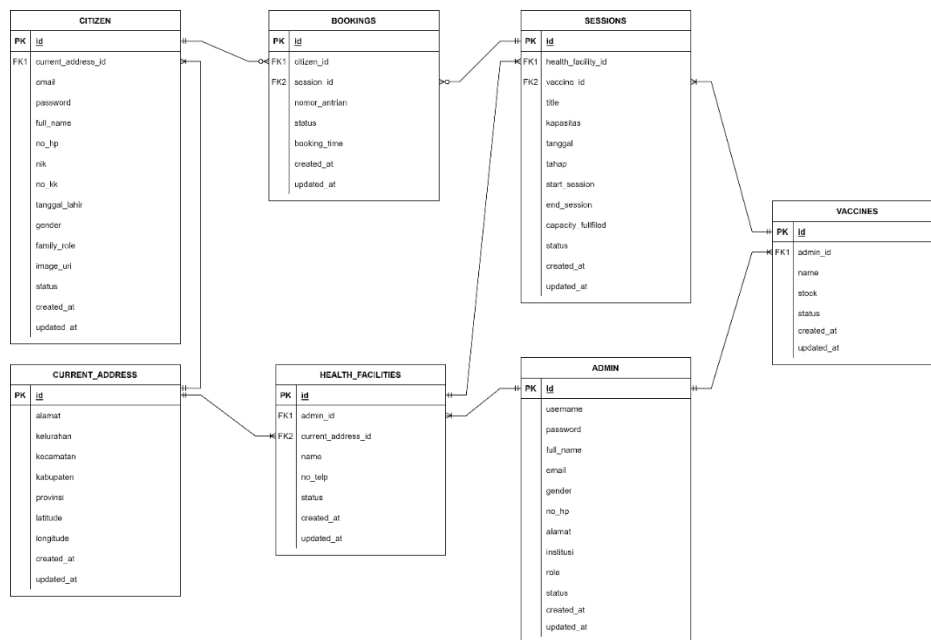


Figure 2. ERD with Crow's Foot notation

### C. Diagrams

If it is described as a whole along with the technology involved in it, then an overview of the system can be seen in Figure 3, the following system architecture diagram:

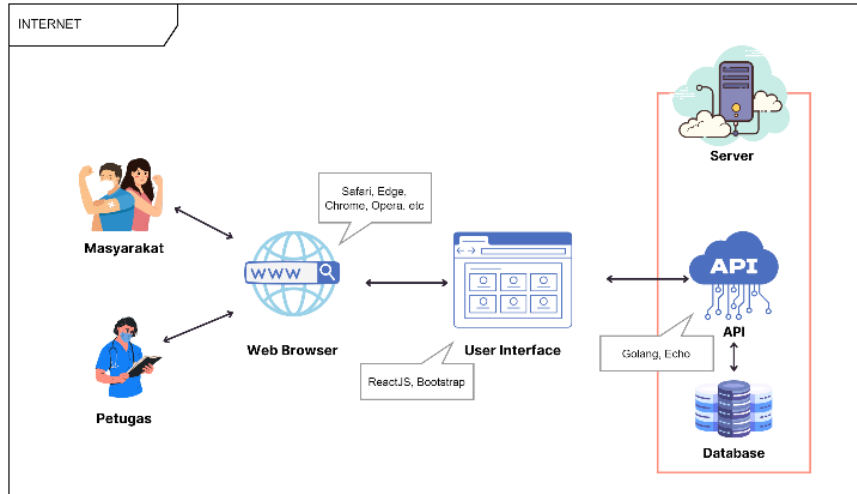


Figure 3. System Architecture Diagram

### D. Use Case Diagrams

Use case diagrams are used to model interactions between the actors involved with the system. Use case diagrams to emphasize "what" the system does and not "how". Figure 4 below is a system design with a use case diagram.

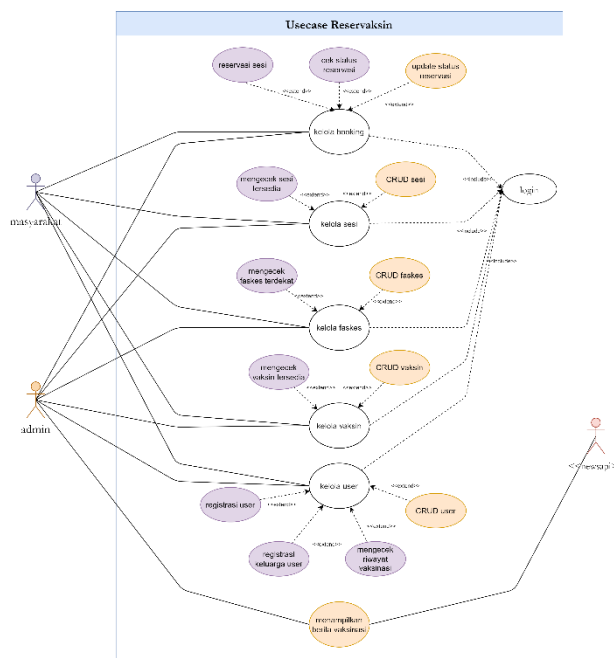


Figure 4. Use case diagrams

### E. API

The API is built using the REST architecture with the Go and Echo programming languages as the web framework[20]. The system also utilizes MySQL as a data storage medium[21]. The implementation of the API is documented through Swagger with five main methods involved (GET, POST, PUT, PATCH, and DELETE), which can be found in Figure 5 below:

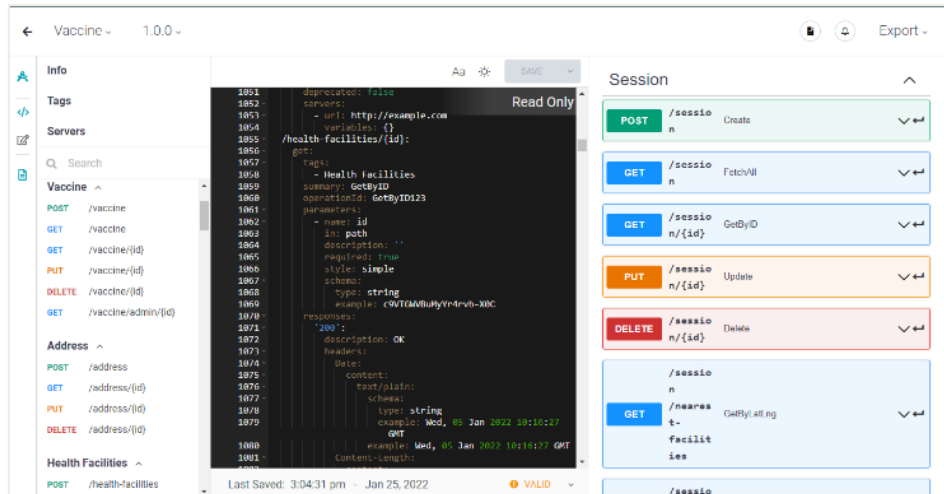


Figure 5. API documentation via swagger

### F. Website Page Display

The main view of the resulting system implements the ReactJS and Bootstrap libraries with two opinions based on access rights, namely the idea of vaccination participants (the general public) and health workers[22]. Figure 6 to 9 below shows a face-to-face view from the side of the vaccination participant, and Figures 10 to 14 are views from the admin side[23].

- a) **Figure 6 Registration Page:** Before being entitled to make a reservation, vaccination participants must register on the registration page by completing their data in the form provided[24]. The community can also write their relatives simultaneously in the registration form. After successfully registering, the user (in this case, the public) will be directed to the main page to log in.

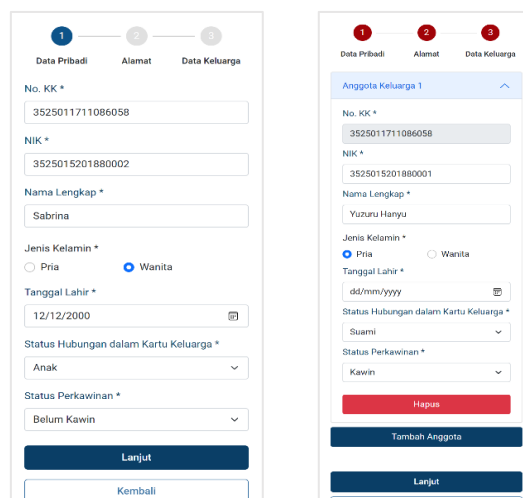


Figure 6. Account registration page

- b) **Figure 7 Reservation Onboarding Page:** As mentioned earlier, people can register their family members. So on the reservation onboarding page, participants must first select participant data before making a reservation. Then the nearest vaccination location will appear based on the participant's site.

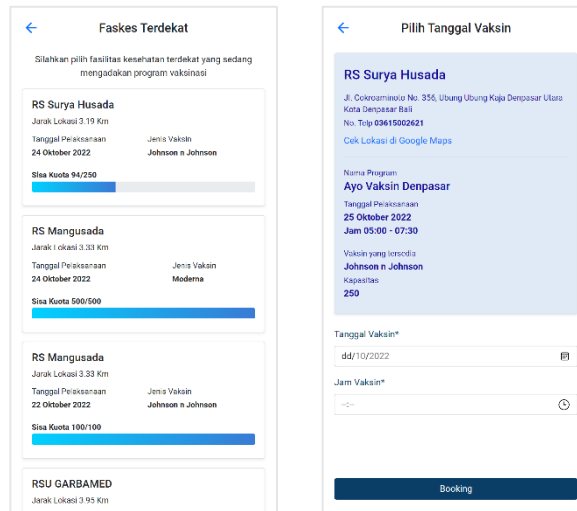


Figure 7 Reservation Onboarding Page

- c) **Figure 8 Reservation Page:** This page will display available vaccination session data from a 10 km radius based on latitude and longitude data (latitude and longitude coordinates) obtained from the participant's GPS. The data is displayed in the form of data on the organizing health facility, type of vaccine, date of vaccination, and remaining quota of participants sorted by shortest distance. After selecting a session, participants will be directed to the session detail page, which contains more detailed information about the vaccination session.

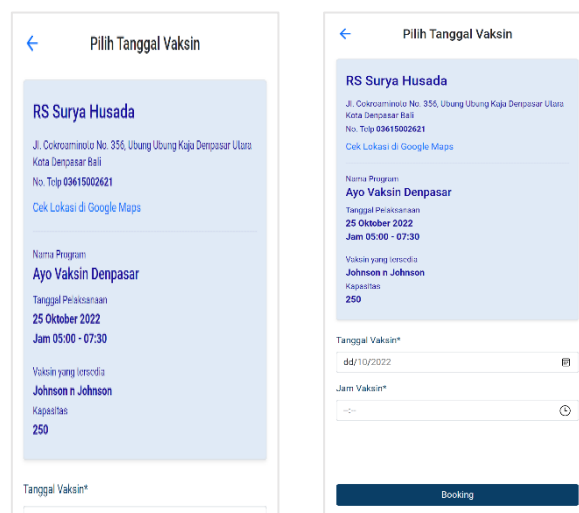


Figure 8 Reservation Page

- d) **Figure 9 Reservation Ticket Page:** After successfully making a reservation for a vaccination session, participants can see proof of uneariness in the form of a ticket on

the vaccination ticket page. The field staff will later show this ticket during the vaccination process.

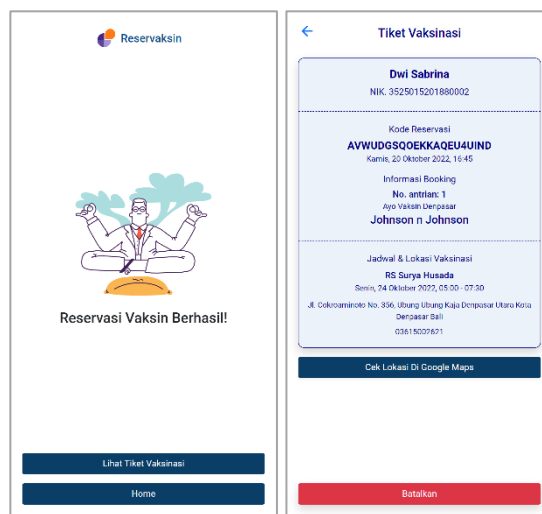


Figure 9. Ticket reservation page

- e) **Figure 10 Manage Health Facilities Page:** Officers must add data on their health facilities before opening a vaccination session. This page has features for adding and updating health facility data. In the additional facility form, the officer must fill in data in the form of the name, telephone number, and complete address of the health facility.

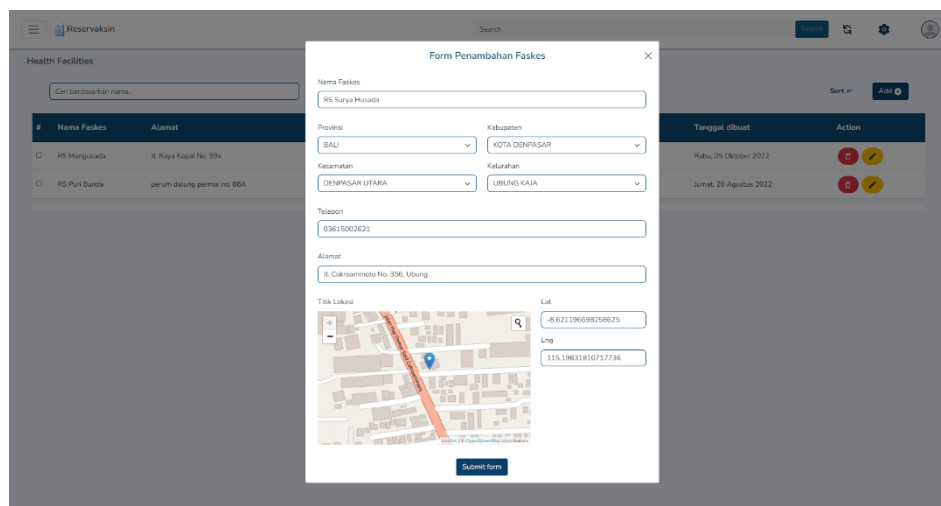


Figure 10. Health facility management page

- f) **Figure 11 Manage Session Page:** On this page, officers can create vaccination sessions based on health facility data and vaccines that have been previously registered. In the session creation form, the officer is also required to provide other information, such as the name of the vaccination session, date of vaccination, time of implementation, and capacity of the vaccination session.

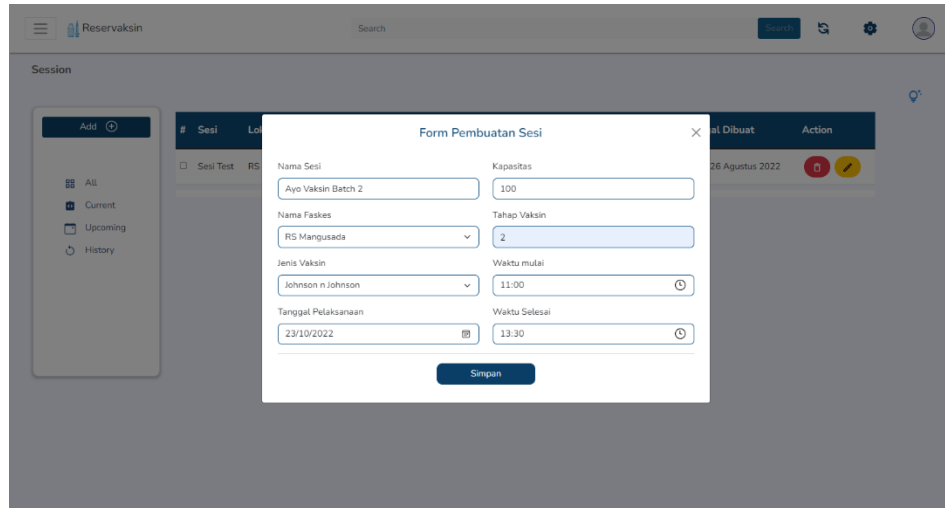
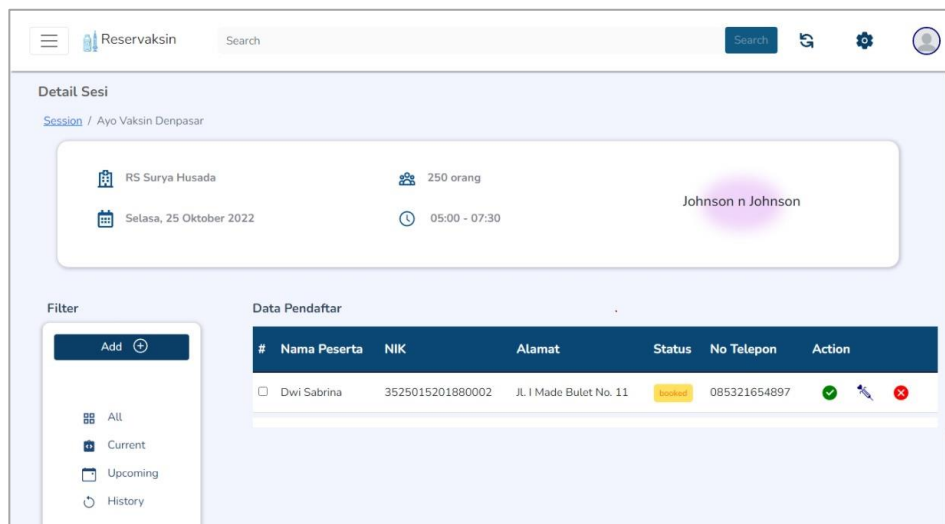


Figure 11. Manage session page

- g) **Figure 12 Session Detail Page:** On this page, the officer can view data on vaccination participants registered for each session. In this case, the officer can also check the field using this data and change the reservation status.



#	Nama Peserta	NIK	Alamat	Status	No Telepon	Action
1	Dwi Sabrina	3525015201880002	Jl. I Made Bulet No. 11	booked	085321654897	✓ ✎ ✖

Figure 12 Session Detail Page

- h) **Figure 13 Participant Data Management Page:** The officer has access rights to update the vaccination participant data on this page. The participant's vaccination reservation history is also displayed.

Figure 13 Participant Data Management Page

### G. Black Box Testing

Based on the testing of the black box testing method carried out [25], the tests described in Table 2 below can be produced:

**Table 2. Test results with the black box testing method**

Tested System	Expected Outcome	Test Result
Registration	If the registration is successful, the data will be saved and the system will redirect to the main page	Be accepted
Login	If the authentication is successful, the system will redirect to the main page	Be accepted
Adding family members	Registration of additional family member data through the registration form was successful	Be accepted
Check the nearest vaccination location	Registration of additional family member data via the registration form was successful. The reservation page has successfully displayed vaccination locations within a 10 km radius	Be accepted
Registration of available vaccination sessions	Vaccination reservation was successful	Be accepted
Check the vaccination ticket	The "schedule my reservation" page successfully displays proof of a vaccination reservation in the form of a ticket	Be accepted
Addition of vaccine data	Saved vaccine data	Be accepted
Update vaccine data	Vaccine data changes have been successfully saved	Be accepted
Addition of health facility data	Health facility data successfully stored	Be accepted

Updating health facility data	Changes to health facility data have been successfully saved	Be accepted
Addition of vaccination session data	Vaccination session data is stored	Be accepted
Update vaccination session data	The changes to the vaccination session data have been successfully saved	Be accepted
Check the reserved vaccination session data	The session details page successfully displays the details of the vaccination session	Be accepted
Update data on vaccination participants	Changes to vaccination participant data have been successfully saved	Be accepted

#### 4. Conclusion

Based on the research, analysis and testing of the system that has been carried out, it can be concluded that the website-based reservation system developed by implementing Golang with the Echo framework (server) and ReactJS with the ReactJS library (client), as well as the MySQL DBMS are valid as third parties for organizing COVID-19 vaccination reservations. The resulting system has two interfaces, namely from the officer's side (admin) and from the community's side (vaccination participants). Officers have the right to manage vaccination session data, vaccine data, health facility data, and vaccination participant data. Meanwhile, vaccination participants (the public) have the right to register accounts, register family members, manage profiles, see the nearest vaccination location, register for a vaccination session, and see tickets for proof of vaccination registration. For further development, you should also be able to build a similar system that can run on mobile platforms, both Android and iOS.

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