

MJ

Multidisciplinary Journals

Volume 3 Issue 3, 2026 (357-368)

ISSN (online) : **3047-8499**

Homepage : <https://jurnalunived.com/index.php/MJ>

Doi : <https://doi.org/10.37676/mj>

Design And Development Of An Android-Based Blood Donation Registration Application At The Bengkulu City Indonesian Red Cross Using Client–Server Architecture

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Received [20-06-2026]

Revised [06-09-2026]

Accepted [09-09-2026]

Abstract. The blood donor registration process at the Indonesian Red Cross (PMI) Bengkulu City branch still faces obstacles, as some of the record-keeping is still done manually and has not been integrated into a centralized system. This leads to delays in data processing, potential recording errors, and difficulties in quickly searching for donor data. This study aims to design an Android-based blood donor registration application using a client-server architecture, where the Android application serves as the client used by prospective donors to register, while the server acts as the central data processing and storage hub accessed through a REST API-based web service. The development method employed includes requirements analysis, system design using Unified Modeling Language (UML), database design, user interface design (wireframes), implementation of the client and server applications, and system testing using the black box testing method. The result of this research is the design of an Android-based blood donor registration application capable of real-time data exchange with the server, making the registration process faster, more accurate, and centralized, while also simplifying the task of PMI Bengkulu City staff in managing donor data.

Keywords: *Android Application, Client-Server Architecture, Blood Donor Registration, PMI Bengkulu City, REST API.*

INTRODUCTION

Optimal healthcare services depend heavily on the availability of an adequate, safe, and readily accessible blood supply when needed. Blood is a vital component in the management of various medical conditions, such as surgical procedures, accidents, childbirth complications, and chronic disease therapy. Therefore, blood donation management must be carried out systematically and in an integrated manner so that blood distribution and provision can operate effectively. Under ideal conditions, a blood donor registration system should make it easy for the public to register quickly through a digital platform, store data in a centralized database, and allow real-time monitoring by staff to support appropriate decision-making (Abimanyu, 2025).

Along with the development of information technology, the use of Android-based mobile applications has become a relevant solution for improving the quality of public services, including in the health sector. The integration of mobile applications with a client-server architecture enables direct data exchange between users and the server, allowing data processing to be carried out quickly and accurately. This system makes it easier for prospective donors to register without having to come directly to the location, while also helping staff manage data more efficiently (Indriyanto, Huda and Qirom, 2022).

Actual conditions in the field indicate that the blood donor data management process at PMI Bengkulu City still faces a number of challenges, particularly in terms of the digitalization of registration services. Some administrative processes are still carried out manually or have not

yet been fully integrated into a centralized system. This has the potential to cause delays in data processing, recording errors, and difficulties in quickly searching for donor data when needed. In addition, the public often does not have easy access to information regarding donation schedules or registration procedures, resulting in suboptimal blood donor participation.

This phenomenon indicates a gap between the need for rapid blood donation services and the still-limited data management system. In some cases, delays in administrative processes may prolong the time required to meet blood needs, particularly in emergency situations. In addition, limited information channels also mean that prospective donors do not receive notifications or reminders to donate regularly. This condition confirms that the use of integrated digital technology is an urgent need for improving the efficiency of blood donation services.

Based on an analysis of the existing problems, the main root cause lies in the absence of a system capable of directly connecting users and staff within a single integrated platform. Manual record-keeping has the potential to cause data duplication and complicate the monitoring process. In addition, the limited use of mobile technology as a medium for interaction with the public makes registration services less flexible. Without a client-server-based system, data exchange cannot be performed in real time, meaning that donor information is not always available accurately and up to date.

As an effort to address these problems, this study proposes the design of an Android-based blood donor registration application using a client-server architecture. In this application design, the mobile application serves as the client used by the public to register, while the server functions as the central data storage and management facility. This approach enables data exchange to be carried out directly through the internet, allowing the resulting information to be delivered more quickly, accurately, and in an integrated manner. In addition, this system can also improve staff work efficiency because data processing is performed automatically and centrally.

The advantage of this study lies in its focus on a client-server architecture that not only provides registration features but also emphasizes real-time data integration between users and the system. Compared with previous studies that generally developed only web-based blood donor information systems or simple applications, this study offers a more comprehensive approach through the use of mobile technology and a centralized system. Therefore, this study is expected to contribute to improving the quality of blood donation services, particularly in terms of administrative process efficiency, data accuracy, and ease of access for the public.

In addition to providing practical benefits for the institution, this study also has academic value because it can serve as a reference for the future development of mobile-based health information systems. The implementation of this system is expected to support the digital transformation of health services, particularly in the management of blood donation services that are more modern, responsive, and technology-based. With an integrated system, the blood donor registration process is expected to become more effective, public participation to increase, and blood needs to be met more optimally.

LITERATURE REVIEW

System Design

System design is an important stage in the information system development process that functions to translate user requirements into models, structures, and technical specifications that will serve as the basis for system development. At this stage, the system architecture, process design, database design, and interface design are determined so that the developed system can meet organizational objectives effectively and efficiently. System design also serves as a blueprint that illustrates how system components interact with one another and how data

flows are processed, thereby minimizing errors during the implementation stage. With a structured design process, system development can be carried out systematically, software quality can be improved, and the resulting solution can be ensured to meet user requirements and the operational environment (Ekarsih et al., 2023).

Registration Application

A registration application is software designed to facilitate the structured recording, management, and storage of user or participant data through digital media. This system is intended to replace manual registration processes that generally require paper-based record-keeping, which may result in recording errors, delays in data processing, and difficulties in retrieving information. Through a registration application, users can independently enter data using devices such as smartphones or computers, while administrators can monitor and manage the data in real time. The implementation of registration applications generally utilizes centralized databases and network technology so that the registration process becomes faster, more accurate, and easier to access. In addition to improving operational efficiency, registration applications also contribute to improving service quality by providing transparent, integrated, and well-documented information (Putri, Fachruddin and Jasmir, 2025).

Client Server

Client-server architecture is a distributed computing model in which the client application serves as the user interface for sending requests, while the server functions as the center for data processing, application logic, and database storage. This model enables tasks to be divided between user devices and the server so that data management can be carried out in a more structured and centralized manner. Communication between the client and server takes place over a network, where the client sends a request and the server provides a response according to the requested process.

In the context of an Android-based blood donor registration application, the mobile device acts as the client used by donors to register, view activity information, and access blood donation services. Through the application, donors can enter personal data, register for blood donation activities, and obtain information regarding activity schedules and locations. Data entered through the Android device are then sent to the server to be processed and stored in the database.

Meanwhile, the server handles data validation, stores donor information, and provides web services that enable real-time data exchange (Ariyanti, 2019). The server's role as the central data management facility also allows the information provided to users to remain integrated and to be updated centrally. Thus, the implementation of client-server architecture in an Android-based blood donor registration application can support donor data management, the delivery of activity information, and registration services in a more effective and organized manner.

Android

Android is a Linux kernel-based operating system developed for mobile devices such as smartphones and tablets and designed to support open-source application development. Android provides a platform that enables developers to build applications by utilizing various components such as user interfaces, memory management, network connectivity, and database integration. In information system development, Android is widely used because of its high flexibility, broad community support, and ability to integrate with web services, making it suitable for client-server-based applications (Khairunnisa, 2022).

REST API and Web Service

A Representational State Transfer (REST) API is a software architectural style used to build web services that enable data communication between clients and servers through the HTTP protocol. In REST architecture, each resource is represented by a specific URL and can be accessed using HTTP methods such as GET, POST, PUT, and DELETE, with data exchange generally using JavaScript Object Notation (JSON) because it is lightweight and easy to process across various platforms (Supono and Armianti, 2021). In the blood donor registration application, the REST API acts as a link between the Android application and the database on the server, so that every registration request, data update, and information retrieval process can be performed in a structured manner and in real time.

Database

A database is a collection of interrelated data stored in an organized manner so that it can be efficiently accessed, managed, and updated by both the system and users. In a client-server architecture, the database is located on the server side and managed using a Database Management System (DBMS) such as MySQL, which allows multiple users to access data simultaneously without causing data conflicts (Wicaksono and Priyambadha, 2025). In the blood donor registration application, the database is used to centrally store donor data, blood type data, blood donation activity schedules, and registration history so that they can be accessed by PMI staff whenever needed.

Unified Modeling Language (UML)

Unified Modeling Language (UML) is a standard modeling language used to visualize, design, and document the structure and behavior of an object-oriented software system. UML consists of several types of diagrams, including use case diagrams that illustrate interactions between actors and the system, activity diagrams that illustrate the workflow of a process, sequence diagrams that illustrate the chronological sequence of interactions between objects, and class diagrams that illustrate class structures and their relationships (Aurellia, Nooriansyah and Amrozi, 2023). In this study, UML is used to design the blood donor registration process flow in the Android application and the interaction between the client application and the server.

METHODS

This study aims to design an Android-based blood donor registration application with a client-server architecture, in which the Android application design serves as the client used by prospective donors to register, while the server serves as the central data processing and storage facility accessed through a REST API-based web service. The development method used includes requirements analysis, system design using Unified Modeling Language (UML), database design, interface design (wireframe), implementation of the client and server applications, and system testing using the black box testing method.

Implementation Method

This study uses the Prototyping development model as the implementation method because the study focuses on the analysis and system design stages without proceeding to the actual coding and deployment stages of the application. The Prototyping model was selected because, conceptually, it allows the process to stop at the design prototype stage, whether in the form of process modeling (UML), database design (ERD), or interface design (wireframe), which can then be evaluated for conformity with user requirements before proceeding to the full development stage by subsequent researchers.

The stages of the Prototyping model applied in this study consist of four stages that proceed iteratively, as follows:

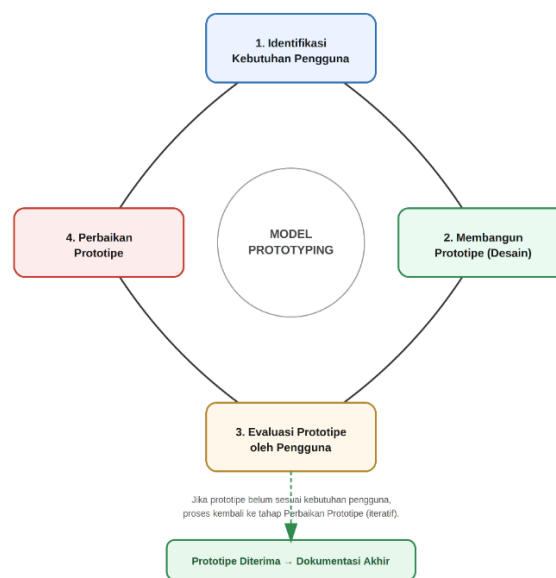


Figure 1 Prototyping Model Stages

The first stage is user requirement identification, which involves collecting data through observation of the current blood donor registration process at PMI Bengkulu City, interviews with staff regarding the constraints encountered, and a literature review of similar studies, thereby identifying the functional and non-functional requirements.

The second stage is prototype development, which involves translating the identified requirements into a process design using Unified Modeling Language (UML), a database design using an Entity Relationship Diagram (ERD), and an interface design in the form of wireframes.

The third stage is prototype evaluation, which involves re-examining the conformity between the resulting design and the established functional and non-functional requirements, including the completeness of process flows in the activity and sequence diagrams, the suitability of the data structure in the ERD, and the ease of navigation flow in the wireframes. The fourth stage is prototype refinement, which involves making adjustments to the design results if discrepancies are identified during the evaluation stage. These two stages are carried out repeatedly (iteratively) until the prototype is deemed appropriate and can be documented as the final design result.

RESULTS

The result of the study is the design of an Android-based blood donor registration application capable of exchanging data with the server in real time, making the registration process faster, more accurate, and centralized, while also making it easier for PMI Bengkulu City staff to manage donor data.

DISCUSSION

Interface design aims to illustrate the appearance of the application to be developed, including the arrangement of elements, navigation flow, and the interactions that users will experience. The interface design is presented in the form of wireframes, namely the initial layout design of each application page before proceeding to the visual design stage. The following wireframes illustrate the structure of interface elements in accordance with the functional flow of the Android-based blood donor registration application.

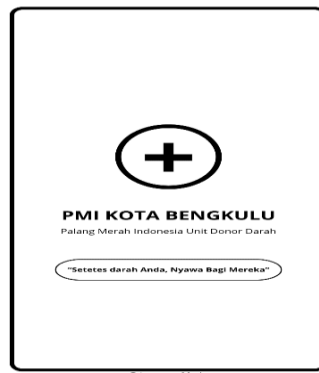


Figure 2 Splash Screen Wireframe

The figure shows the splash screen of the "DonorPMI Bengkulu" application, which appears first when the application is opened. This screen displays the application title "DonorPMI Bengkulu" and the subtitle "Online Blood Donor Registration". At the bottom of the screen, the text "Application internet..." indicates that the application is checking the internet connection before entering the main page.

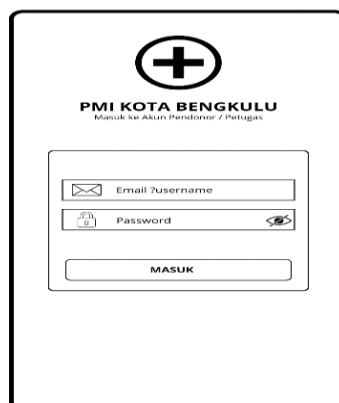


Figure 3 Login Page Wireframe

The figure shows the *Login* page of the "DonorPMI Bengkulu" application. On this page, prospective donors are required to enter their account credentials before they can access blood donor registration services. There are two input fields, namely "Email" and "Password", as well as a "Login" button to continue the login process. At the bottom of the page, the text "Don't have an account? Register" serves as a link directing users to the new account registration page if they do not yet have an account.

Figure 4 Registration Page Wireframe

The figure shows the *Account Registration* page of the "DonorPMI Bengkulu" application. This page is used by prospective donors who do not yet have an account to register a new account before they can access blood donor registration services. There are six input fields that must be completed, namely Full Name, NIK, Email, Mobile Number, Blood Type, and Password. At the bottom, there is a "REGISTER" button to complete the registration process, as well as the link "Already have an account? Login", which directs users back to the login page if they already have an account.

Figure 5 Home Page Wireframe

The figure shows the *Home* page of the "DonorPMI Bengkulu" application after the user has successfully logged in. At the top of the page, there is the greeting "Hello, Habib" along with the user's blood type information, namely "O+". Below it, there is a notification or brief announcement regarding blood stock, namely "O- blood stock menjen at Palt" (possibly an abbreviation for "running low" or indicating limited stock at PMI). Next, there are four main menus in the form of buttons or cards, namely "Register to Donate", "History", "Donation Schedule", and "Profile". At the very bottom, there is a *bottom navigation* bar consisting of four menu icons: Home, Schedule, History, and Profile, which makes it easier for users to move between application pages.


From Pendaftaran Pendonor

Pendonor : **Habibi Al Hasan**
 No. 1 Pendidikan Cak Nurah Abi (Pondok)



1. Lokasi & Waktu Donor

Pilih lokasi Donor :

Tanggal Pelaksanaan :

Pilih jam kedatangan

☐ 08:00-10:00 WIB	☐ 10:00-12:00 WIB
☐ 13:00-15:00 WIB	☐ 15:00-17:00 WIB

2. Skrinings Kesehatan mandiri

☒ Berat Badah (kg)

☐ Lama Tidur (jam)

☐ Saya dalam kondisi sehat dan fit

☐ Saya sedang mengonsumsi obat-obatan / anti biotik. 3 hari terakhir

☐ Catatan kesehatan tambahan (Opsional)

KIRIM PENDAFTARAN DONOR

Figure 6 Donor Registration Form Wireframe

The figure shows the *Donor Registration Form* page of the "DonorPMI Bengkulu" application. This page is used by prospective donors who have logged in to enter blood donor registration data. Several input fields must be completed, namely Full Name (automatically populated from the account data), Blood Type, Body Weight (kg), Date of Birth, Address, Telephone Number, and Donation Location/Schedule. At the bottom of the form, there is a consent statement with the text "I declare that the data are prohibited and mention a guarantee" (possibly intended as a statement that the entered data are correct and can be accounted for). Finally, there is a "SUBMIT REGISTRATION" button to send the registration form to the server.


Rikayat & Pendaftaran

Total Partisipan: 9 Kali Donor
(penghargaan PMI) Periode Butiri (5+Kali)

Rikayat Seleksi(3)

Pendaftaran Aktif (9)

12 November 2025
Lokasi: Gedung Teknikal UPM

8 Februari 2026
Lokasi: Medan Jarak 4000 Km

10 Mei 2026
Lokasi: UPM PMI Kota Bengkulu

Figure 7 Donation History Page Wireframe

The figure shows the *Donation History* page of the "DonorPMI Bengkulu" application. This page displays a list of the user's previous blood donations. Each history entry is displayed as a card containing information on the donation date (for example, 12 Mar 2026, 02 Dec 2025, and 15 Sep 2025) and the donation location (such as PMI Bengkulu City and the UNIB Mobile Unit). On the right side of each card, there is a *toggle button* that may be used to mark or verify the donation status. At the bottom of the page, there is a *Message* area that may be used to display additional information or notifications related to the donation history.

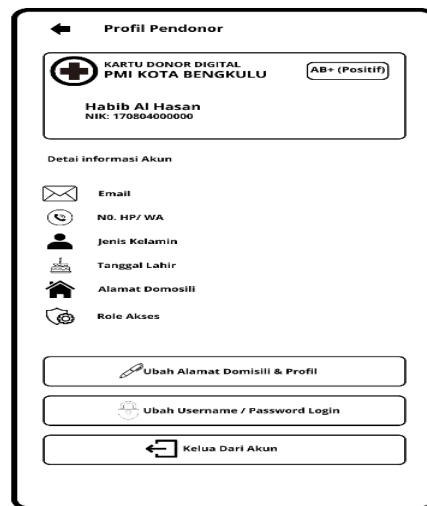


Figure 8 Profile Page Wireframe

The figure shows the *My Profile* page of the "DonorPMI Bengkulu" application. This page displays the personal information of the currently logged-in user. At the top, the user's name, "Habib Al Hasan", is shown along with the blood type information "O+". Below it, several user data fields are displayed, namely Email, Mobile Number, Alternative, and Date of Birth. At the bottom of the page, there are two action buttons, namely "EDIT PROFILE" for changing the user's profile data and "LOG OUT" for logging out of the account.

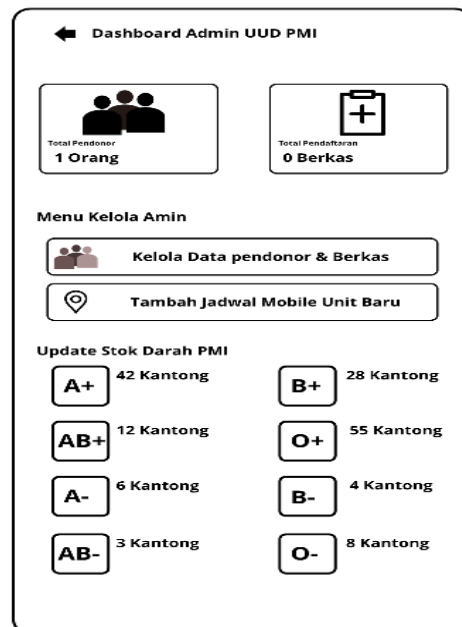


Figure 9 PMI Admin Dashboard Wireframe

The figure shows the *PMI Admin Dashboard* page of the "DonorPMI Bengkulu" application. This page is used by PMI staff to monitor and manage blood donor registration data as a whole. At the top, there are three statistical cards displaying a data summary, namely "Total Pending" with 482, "Awaiting Verification" with 17, and "Transactions" with 465. Below

them, there is a table listing prospective donors with the columns Name, Blood Type, Date, and Status. Examples of the displayed data include Ahmad Faasil (O+, 01/01/26, Verified), Siti Aminah (A+, 02/01/26, Pending), and Budi Santoso (B+, 05/01/26, Verified). This table makes it easier for staff to monitor the status of each blood donor registration.

CONCLUSIONS

The client-server architecture for the Android-based blood donor registration application at PMI Bengkulu City has been successfully designed, including process design using use case diagrams, activity diagrams, sequence diagrams, and class diagrams, as well as database design using an Entity Relationship Diagram (ERD), so that the data communication flow between the client application and the server can be described clearly and systematically.

The implementation design of the Android application as the client and the REST API as the server has been prepared in the form of technical specifications and an API endpoint structure, demonstrating how donor registration data exchange can be carried out in real time and centrally when implemented at the subsequent development stage.

SUGGESTIONS

The design produced in this study can be continued to the actual implementation (coding) stage, both on the Android application side and the REST API server side, so that the system can be tested directly under the operational conditions of PMI Bengkulu City. This design is still limited to a prototype system; for future research, it is recommended to build a system in accordance with the design presented in this report.

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