DEVELOPMENT OF PROGRESSIVE WEB APP (PWA) BASED BLOOD DONOR APPLICATION IN PMI PESISIR SELATAN

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Abstract - Blood donation is an important voluntary activity for blood transfusion. However, data from the Indonesian Red Cross (PMI) shows that blood stocks have not reached the ideal requirement of 5.56 million bags per year. This indicates the need for improvement in the management and dissemination of information related to blood donation to increase community participation. Information technology, particularly Progressive Web App (PWA), can improve efficiency and accessibility in blood donation activities. PWA allows easier and faster access to donor information without the need to download additional applications. With responsive design and the ability to work offline, PWA overcomes the limitations of native applications and increases public participation in blood donation. In this research, the prototype method was used in designing the application. The Prototype method is used with the aim that developers and users can interact with each other during the software development process, so that the resulting software is in accordance with the wishes and needs of the user. This research proposes the development of a PWA-based blood donor application at PMI Pesisir Selatan to improve donor management, accelerate information distribution, and optimize coordination of blood donor activities. Tests were conducted using GTmetrix, based on the test results it can be concluded that the performance of this site is relatively good, with GTmetrix Grade reaching a B value. More specifically, the site recorded a Performance score of 81% and Structure score of 88%. This indicates that the site has a fairly optimized loading speed and layout. This application is expected to facilitate registration, and blood stock information, as well as improve overall efficiency in blood donation activities, answering the challenges and needs in increasing community participation.

Keywords- Blood Donation, Progressive Web App (PWA), Efficiency, Blood Stock Management, Community Participation

I. INTRODUCTION

Technology is a variety of things that can alleviate human activities. The development of science and technology today makes information technology an important aspect of people's lives and part of the lifestyle of modern society today [1]. Blood donation is a blood donation activity carried out voluntarily by the community to be stored in blood banks as stock, with the aim of helping blood transfusions for people in need [2].

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According to data from the field at the Indonesian Red Cross (PMI), the blood stock owned by blood donor units (UDD) throughout Indonesia is 77,438 bags as of June 14, 2023. Of this amount, the most O+ blood stock is 29,825 bags. According to the World Health Organization (WHO), the total need for blood bags in each country should ideally be 2% of the total population. With a population of 277.75 million in 2022, the number of blood bags needed by Indonesia is estimated at 5.56 million per year.

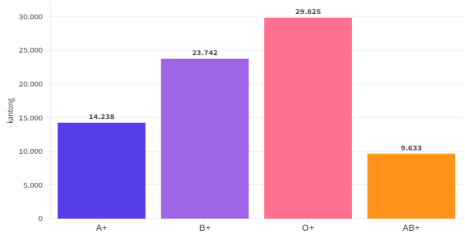

Fig 1. Blood Stock of Blood Donor Units at PMI (as of June 14, 2023)

Information technology support is needed to speed up the process of disseminating and analyzing data into important information needed by users. Information technology support designed to meet the needs of blood in PMI Pesisir Selatan is in the form of a blood donor application which is a collaboration between website and mobile technology so that it becomes an effective solution in providing information about the location, schedule, and blood donor requirements to the public quickly and easily. In addition, this website and

mobile technology is also supported by Progressive Web App (PWA) Technology.

PWA is a concept that provides users with a desktop and mobile application-like display delivered directly from a web browser[3]. PWA is useful for users from the first time they open a web page with the PWA concept, and as more users use web applications, the application will become more powerful [4].

Progressive Web Apps (PWA) are web applications that load like web pages but can offer user functionality such as working offline, notifications, and hardware access[5]. PWAs deliver broad accessibility through a web-based platform without the need for additional application installations, thus allowing blood donors to easily get up-to-date information on nearby donor locations, event schedules, and donor requirements.

By utilizing PWA technology, web-based applications can be developed using only HTML, CSS, and Javascript technologies, and can be run like native applications on devices with Android and iOS operating systems [6].

This PWA technology works by making a web to be installed on the user's device, where the web will also have an icon on the mobile home screen like a native application in general. PWA is useful for users from the first time they open a web page with the PWA concept, and as users use the web application more and more, the application will become more and more powerful. Applications can load quickly, even in poor internet conditions, can send push notifications, have an application icon on the home screen, and can run in full screen mode.

Some research has been done in applying this PWA technology such as utilizing PWA in the design of the final project repository system, a system that does not have the characteristics of the modern web where the main problem is the need for a website to be accessed online or offline. The results of this research by utilizing service workers on PWA can make the system independent of connectivity and with the web app manifest the system can pop-up dialogs on the homescreen [7]

Other research on Progressive Web App (PWA), namely the Education Development Contribution Payment Administration Application (SPP), this research aims to build and design an application for the administration of Education Development Contribution (SPP) payments that can optimize the administration of SPP payments to be more effective and efficient supported by Progressive Web App-based information technology that can be accessed and displayed properly on various devices such as desktops and cars.

The next research is the utilization of PWA for learning media that requires fast and interactive access. The results of the study state that websites that use Progressive Web App can respond better, especially at the point of being able to respond offline. In a bad internet connection, it is undeniable that websites that use Progressive Web App can respond much better than ordinary websites [8].

The PWA structure consists of several key components that work together to provide an optimal user experience. The Web App Manifest is a simple JSON document that organizes the display and execution of the application by the user[9]. This manifest file is commonly named manifest. This manifest specifies how the application appears to the user and how it can be installed, with information such as the application name, icon, color theme, and starting URL.

The second component is the service worker, the service worker is a script that functions to get the offline mode feature, so that it can make it easier for users to be able to access the website even in unstable connection conditions [10]. Service worker is a key element that allows PWA to work offline and load content quickly.

The third component is Application Shell Architecture, which is an approach that uses a basic application framework (shell) that loads quickly and gives users the impression of a native application. Dynamic content is then loaded and updated within this framework.

According to data obtained from PMI Pesisir Selatan, there is an increasing trend of blood demand every year in line with population growth and growing medical activities. However, the data also shows that there is still a gap between the blood demand and the number of active donors.

Based on historical data of blood donation activities, it can be seen that there are fluctuations in the number of donors from time to time, especially during certain periods such as the holiday season or certain times that are considered less conducive to social activities. In addition, the data also shows that the process of registering donors and managing information related to blood donation activities still uses manual methods that tend to be time-consuming and inefficient. This can hamper the potential for community participation in blood donation activities.

In addressing this challenge, the development of a web-based blood donor application is a potential solution. Through this platform, users can easily find the nearest blood donor location, check the availability of blood stocks, and get the latest information regarding the need for blood donations in various regions. The main objective of this application is to increase public awareness and participation in blood donation activities, as well as ensuring adequate blood availability for medical needs.

II. RESEARCH METHODOLOGY

The method used in system development is prototype. Prototype is an early version of software that is used to demonstrate concepts, try out various design options, and explore more problems and solutions..

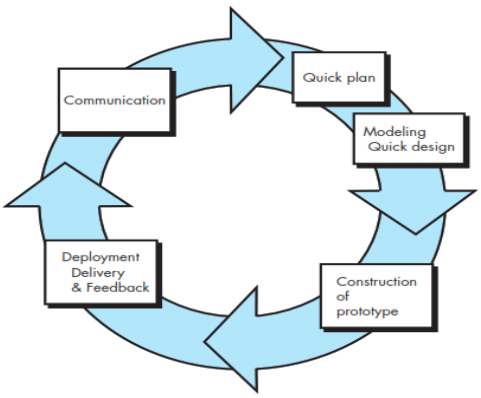

Fig 2. Prototype method

A. Communication

Communication is the initial stage in system design which aims to obtain data to analyze user and system needs. At this stage, communication with users is built by interviewing members of the target group.

Communication or interviews are conducted with parties from PMI Pesisir Selatan as users or users of this blood donor application. At this stage of communication, some data and facts related to the state of the data processing system that is running at PMI Pesisir Selatan are obtained.

B. Quick Plan

At this stage, the analysis and planning of the needs used in designing the PWA-based blood donor application at PMI Pesisir Selatan is carried out.

1. Software Requirements Analysis
   a. Sublime Text
      Sublime text is a text editor that is used to create application programs automatically to make it easier for programmers to type editor code..
   b. XAMPP
      Xampp is a free software package consisting of Apache, MySQL (or MariaDB), PHP, and Perl, which is used to run a local web server on a computer. XAMPP provides an easy-to-use development environment for web developers to create and test web applications without having to upload them to an actual web server.
   c. MySql
      MySQL is a software and database creation system that is open source to run on all forms. MySQL is one type of database server as a source and data processing for building web applications.
   d. PhpMyAdmin
      PhpMyAdmin is a web server that is used to manage the database of web programs that have been created where the program must be in accordance with the database.
2. Hardware Requirements Analysis
   The hardware needed for the development of this blood donor application is as follows:
   a. DESKTOP-EXPERTCOM
   b. Intel(R) Core(TM) i5-3230M CPU @ 2.60GHz 2.60 GHz
   c. RAM 4 GB

C. Modeling Quick Design (Design Creation)

Modeling Quick Design is the design of the application workflow to be created as well as the design of actors and processes that will interact with the application using the Unified Modeling Language (UML). This process begins with gathering information from users, especially from PMI Pesisir Selatan, to understand their needs and expectations of the application.

After the information was collected, the next step was to identify the actors involved, such as users, administrators, and other related parties, and define the processes that would occur in the application, such as registration, data management, and reporting. With the actors and processes identified, then create a UML diagram that helps visualize the interaction between the actors and the system as well as the workflow that will be followed.

Once the diagram is complete, a design validation session with the user follows to ensure that all their needs have been accommodated. If there is feedback indicating that there are unmet needs, revisions will be made to the diagram and discussed again.

This quick design modeling process is iterative, so improvements are made until the final design is approved. All diagrams and related explanations are then documented to be used as a reference in the next stage of development. With this approach, it can be ensured that the developed application not only meets user needs, but also has a clear and organized structure, and minimizes the risk of errors in application development.

D. Contruction of Prototype

After the design analysis is complete, the next step is the formation of the prototype, which is the implementation of the design that has been made in the form of program writing. At this stage, we will start coding the application based on UML diagrams and agreed specifications. This process involves selecting the right technology, developing the user interface, and integrating various system components to ensure that all planned functions can run properly.

After the application has been developed, the next step is to test the application to ensure that all features function as expected and meet user needs. This testing includes various types of testing, such as functional testing, integration testing, and user testing, which aims to get direct feedback regarding their experience when using the application.

E. Deployment Delivery & Feedback.

After the prototype development and testing process is complete, the next step is the Deployment Delivery & Feedback stage. At this stage, the blood donor application that has been developed will be implemented and delivered to the end user. Testing is done to ensure that the application performs optimally according to the desired needs and goals, making it a very important stage in the software development cycle. This testing aims to verify whether the application works properly and meets the requirements that have been set, including functionality, performance, and security.

Once the app is launched, developers also collect feedback from users to evaluate their experience in using the app. This feedback is invaluable to identify areas that need to be fixed or improved, as well as to understand whether the app has met user expectations. If issues or new needs are discovered, the development

team will respond by making the necessary fixes and updates. With this approach, not only does it ensure that the developed app can function properly, but it is also committed to continuously improving the quality and relevance of the app based on user feedback.

III. RESULTS AND DISCUSSION

In this discussion section the author presents a discussion of what we will encounter in the blood donor application, menus and steps in operation.

SYSTEM DESIGN

The design of this web-based application using the Unified Modeling Language (UML) as a modeling language as follows:

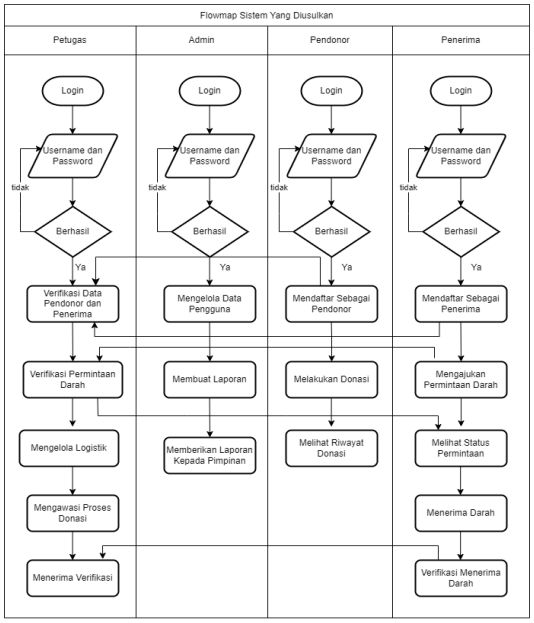

Fig 3. flowmap

This blood donor application flowmap illustrates the proposed workflow to improve blood donor management efficiency and information accessibility to the community.

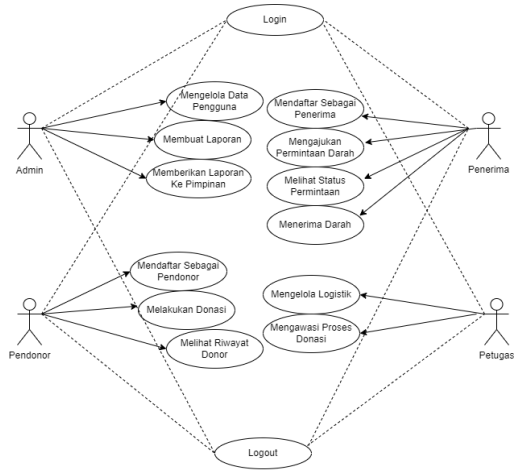

Fig 4. Use Case Diagram

The use case diagram above explains the activities that can be carried out by each user or actor, namely admin, donors, recipients and PMI leaders.

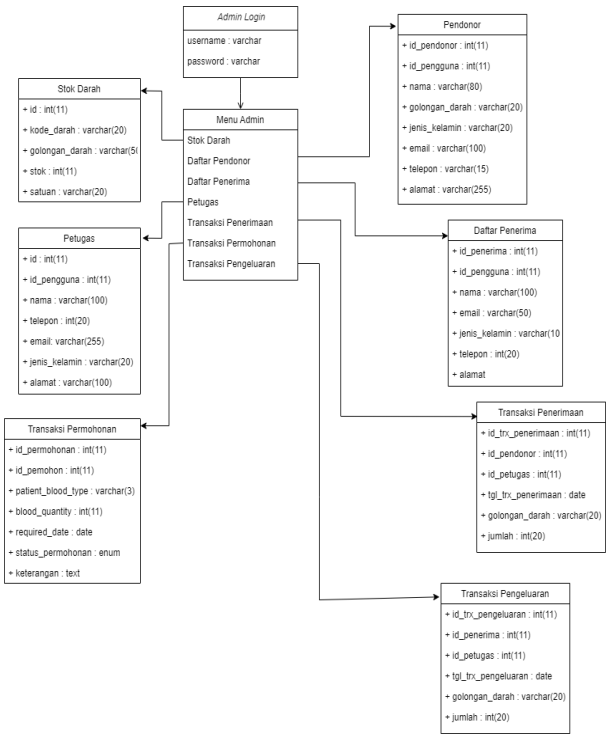

Fig 5. Class Diagram

This Class Diagram describes the structure of the system in terms of defining the classes that will be created to build the blood donor application.

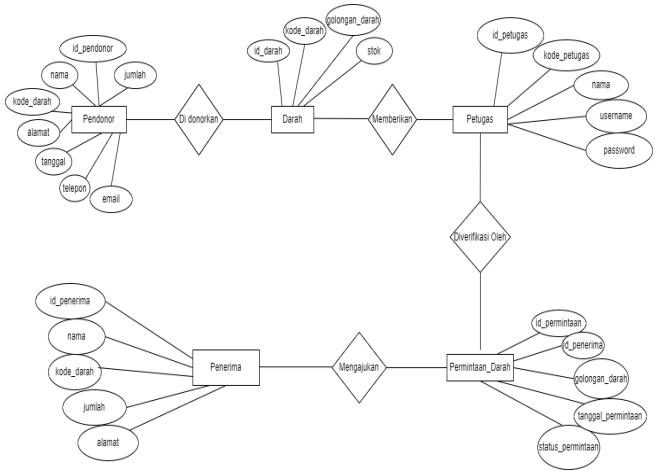

Fig 6. ERD

Figure 6 is a database structure consisting of a number of interconnected tables to support the functionality of the blood donor system. These tables represent the main entities that play a role in managing blood donor information, as well as other related processes.

Tahapan The system implementation stage is the stage of changing the previously designed system into a system that can be run on various platforms or hardware.

A. Login Page

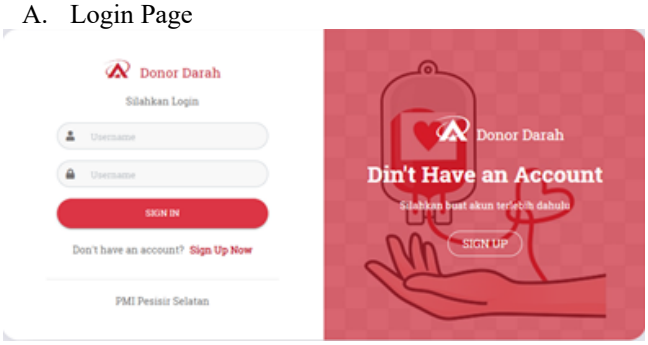

Fig 7. Login Page

In the design of the Login menu page display, there are three features including the login button, username input and password input in the application. This page serves to enter the system by entering the username and password that has been registered. If you don't have an account, the user can click on the “Sign Up” section on the login page.

B. Admin Dashboard Page

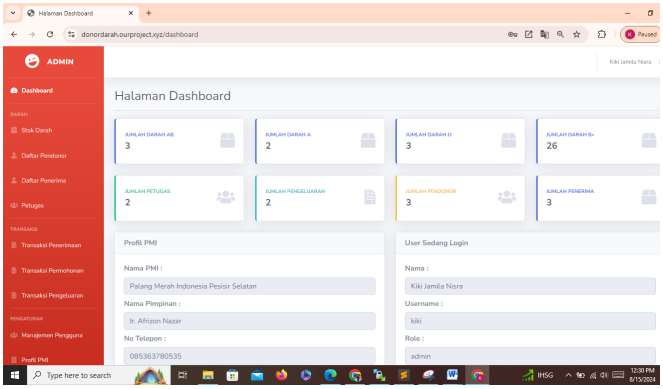

Fig 8. Admin Dashboard Page

The admin dashboard page is the main view that appears after the admin logs into the application or website. The dashboard serves as a control center where users can view important information and access the main features easily.

On the admin dashboard page there are 9 menus namely, blood stock, Donor List, Recipient List, Officer, Receipt Transaction, Request Transaction, Expenditure Transaction, User Management, and Profile.

C. Home Page

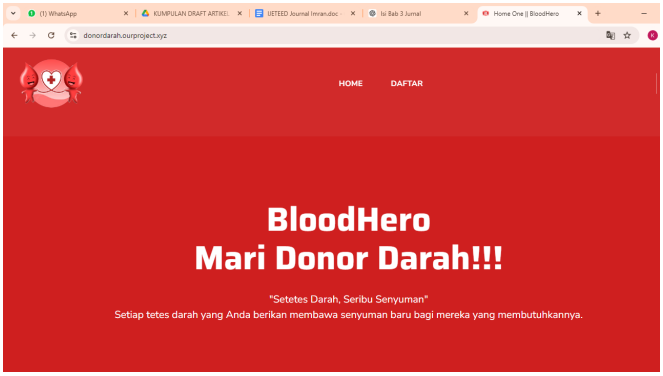

Fig 9. Home Page

Figure 9 shows the main page that users first visit when accessing the system. This page serves to introduce the identity of the site, display links to other main pages, and provide an overview of the available content. On this page, there is a main menu “Register” which has sub-menus “Recipient”, “Donor”, and “Login”.

D. Donor Dashboard Page

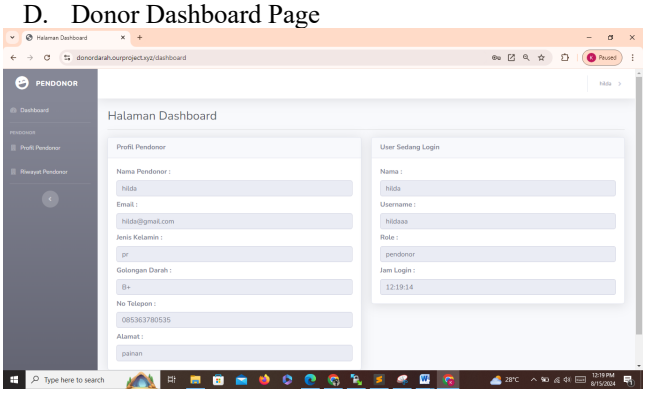

Fig 10. Donor Dashboard Page

On the donor dashboard page, there are 2 menus, namely donor profile and donor history. In the Donor Profile section, important information such as name, email, gender, blood type, phone number, and donor address are displayed. In addition, there is a donation history that shows a complete list of all blood donations that have been made by the donor.

E. Recipient Dashboard Page

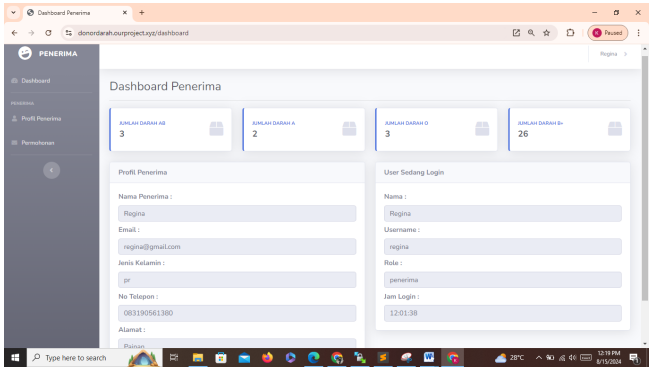

Fig 11. Recipient Dashboard Page

The Recipient Dashboard page is the main page designed to display important information for blood recipients. There are three main menus on this page, namely Dashboard, Recipient Profile, and Request. The Dashboard menu directs users to the main page that contains recipient profile information as well as real-time updated blood availability data.

F. Blood Application Page

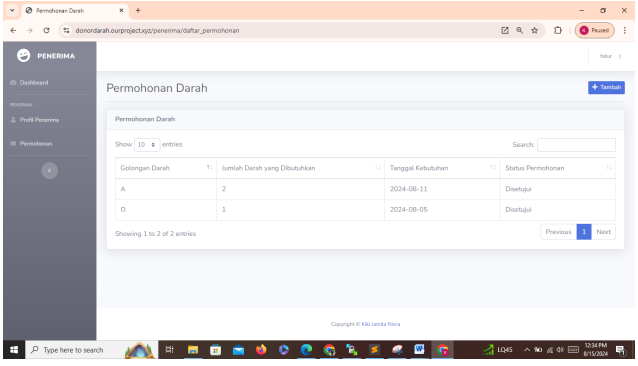

Fig 12. Blood Request Page

This feature allows recipients to directly request for blood that matches their needs. On the request menu, blood

recipients can add a request for blood if they are still in need. This feature allows recipients to directly request for blood that suits their needs.

G. App Install Page

Fig 13. App Install Page

In Figure 13, it can be seen that after the system runs, the blood donor web can be installed into an application on a mobile device with the condition that it must use a browser that supports PWA such as Google chrome. Just add the main screen and the application will be installed, then the application will be installed on the home screen.

H. Add To Home Screen Display on Smartphone

Fig 14. Smartphone Display

Figure 14 is the display after being added to the home screen and can be accessed using the user's smartphone.

SYSTEM TESTING

System testing uses GTmetrix which aims to evaluate the performance and access speed of a website. Testing is done by entering the system URL on the GTmetrix home page. Figure 15 shows an example of testing with GTmetrix.

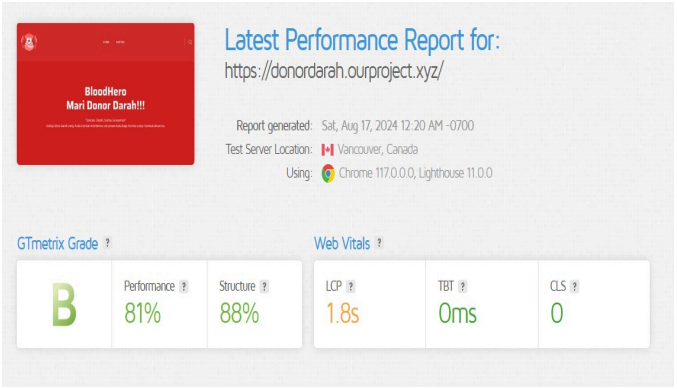

Fig 15. GTmetrix Testing

Based on the results of testing conducted using GTmetrix, it can be concluded that the site's performance is good, with a GTmetrix Grade that reaches a B. More specifically, the site recorded a Performance score of 81% and a Structure score of 88%. This shows that the site has a fairly optimized loading speed and layout.

The app shows significant advantages compared to the manual method used by PMI Pesisir Selatan, especially in terms of efficiency and collaboration. With task automation and reminders, the app speeds up the project management process, while accessibility from various devices with an internet connection allows users to manage projects anytime and anywhere. Real-time collaboration features facilitate more effective teamwork, and centralized data management reduces the risk of information loss and recording errors.

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TABLE 1
COMPARISON OF PMI MANUAL METHOD
AND BLOOD DONATION APP

Aspects	Manual Method	Blood Donor App
Time Efficiency	The process of managing donors and schedules is done manually, taking time and effort.	Automate the registration process and schedule management, saving time for staff and donors.
Accessibility	Donor information and data are stored in physical documents, difficult to access when needed.	Dapat diakses secara online melalui berbagai perangkat, memudahkan pencarian informasi donor.
Data Management	Donor data is managed manually, risking information loss and recording errors.	Centralized and organized data, with the ability to generate automated reports and data analysis.
User Engagement	Donor engagement relies on direct communication and physical announcements.	Encourage user engagement through notifications, reminders and interactive features within the app.

From the table above, it can be concluded that the Blood Donor App is significantly superior to the manual method used by PMI Pesisir Selatan. The app increases time efficiency through process automation, facilitates online access to information, and supports real-time collaboration between officers and donors.

IV. CONCLUSIONS

In The conclusion of this research is that the developed PWA-based blood donor application successfully facilitates administration in processing donor data, blood stock, and emergency information services. With this application, the level of accuracy of the data and information presented is higher, so it is expected to help recipients in making blood requests more efficiently. This innovation not only provides convenience for the administration, but also contributes to increased responsiveness in emergency situations.

For future development, the author expects some updates that can further improve the functionality of the application. One of them is the integration of artificial intelligence (AI) for donor matching, which is expected to speed up the process of finding donors who match the needs of a particular blood type. Additionally, improvements to offline functionality are also planned to ensure the app's accessibility in remote areas, where internet connection may be limited. With these measures, it is expected that the app can provide greater benefits to the community and improve efficiency in the overall management of blood donation.

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