International Journal Software Engineering and Computer Science (IJSECS) 3 (3), **2023, 230-237**
Published Online December 2023 in IJSECS (http://www.journal.lembagakita.org/index.php/ijsecs)
P-ISSN : 2776-4869, E-ISSN : 2776-3242. DOI: https://doi.org/10.35870/ijsecs.v3i3.1762.

Implementation of A Blood Donor Information System Using Mobile Applications Gunung Kidul District

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Received: 27 October 2023; Accepted: 17 November 2023; Published: 1 December 2023.

Abstract: Blood donation is a common charitable activity in many communities. Consequently, the Indonesian Red Cross (PMI) in the Gunung Kidul district frequently organizes such humanitarian events across various locations. However, not everyone is aware of these events or is able to participate in blood donation. The lack of information dissemination and blood donation events are significant factors contributing to the low community participation. The existing system for searching, processing, and creating data is still manual, which hinders the efficiency of administrative tasks. Addressing these issues, the aim of this research is to develop an Android-based blood donation information application. This initiative is particularly vital as the PMI in Gunung Kidul lacks the necessary infrastructure to disseminate information about the availability of blood bags efficiently. In the current era of digital advancement, the slow pace of information distribution is notably ineffective, thus integrating the system with Android technology is a strategic solution. sThis blood donation application is designed for donors who lack information about blood donation activities and for organizations wishing to conduct such events. The development of this Android application system involves experimental data collection methods, including observation, interviews, literature study, and documentation. The unit testing employs the Waterfall methodology. The application is developed using the Kotlin programming language, with the aid of Android Studio software.

Keywords: Application; Android; Blood Donors; PMI; Gunung Kidul.

1. Introduction

The rapid technological evolution has greatly simplified user tasks and needs within the realm of information systems. These systems have been growing at an accelerated pace, continuously evolving with each passing year through new innovations. Such advancements in information systems have been instrumental in benefiting human life, both internally and externally [1]. One notable application is in assisting the Indonesian Red Cross (PMI) with the management of blood donor data and procuring current administrative information from diverse sources. This enhancement significantly improves decision-making processes and elevates community services [2]. Blood, a vital component of the human body, serves critical functions such as delivering oxygen and nutrients and clearing metabolic waste. Despite its importance, blood donation often remains underemphasized. Blood donation plays a key role in palliative care, particularly for patients suffering from severe or life-threatening conditions. The act of donating blood brings multiple health benefits to donors, including reduced risk of heart disease, calorie burning, lowered cancer risk, enhanced blood production, and potential cholesterol reduction [3].

In terms of blood donation, PMI occasionally provides various methods for participation: direct visits to their centers or attending PMI-organized events [4]. However, community members sometimes face challenges in participating in blood donation due to distance from PMI locations and limited information dissemination. Many people are willing to donate blood to help others, but the lack of accessible information on how to find schedules and details about blood donation activities remains a barrier [5]. Consequently, the information sector within PMI needs enhancement to provide

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optimal health services to the public. Effective service is characterized by being fast, accurate, accessible, and friendly [6].

Currently, public health services are not sufficiently effective and efficient, primarily due to the manual process of personal data entry and the time-consuming nature of physically visiting blood donation sites, especially when they are far from donors' residences [7]. The ideal solution would be the development of a system that provides information on blood donation locations and allows data input via mobile devices [8]. PMI, as a blood donation unit in Indonesia, faces several challenges, including technology that does not fully reach the younger generation, the conventional use of blood donor cards impacting budgets, and constraints in spreading information about the locations of mobile blood donation units [9]. With the current generation's close association with technology, PMI must adapt its social media campaigns to utilize technology more effectively, potentially increasing engagement due to the prevalent use of mobile phones in daily life [9]. Therefore, PMI in Gunung Kidul must acquire technology capable of managing and disseminating blood donation information relevant to the current generation. Other research sources suggest that in healthcare services, blood donation is a complex and time-consuming process, particularly in finding compatible blood donors for patients [10].

As of now, PMI in Gunung Kidul has not adopted an application-based system. Thus, the development of an Android-based blood donation application could serve as a solution to bridge the gap between the community and PMI, facilitating anytime, anywhere connectivity. This application aims to assist PMI in broadcasting messages through a blood donation app [11]. Implementing this app-based system would enable effective and efficient data processing, especially in terms of storing and accessing blood donor data and generating necessary reports [11]. To keep pace with technological advancements, and drawing from previous research, this study aims to develop a system that simplifies the blood donation registration process, making it easier for the community to register without the need to visit PMI centers physically. The community would also receive information about upcoming or ongoing PMI-organized events in their vicinity. This research aims to design an Android-based blood donor information system in Gunung Kidul, with the expectation that this application will benefit both the community and PMI. The design of this application utilizes Android Studio software and the Kotlin programming language.

2. Research Method

This chapter delineates the structured approach to composing the full text, covering the article section, systematic chapter, and its detailed contents.

2.1. Research Stages

To clarify the flow of the research stages, the following diagram is presented:

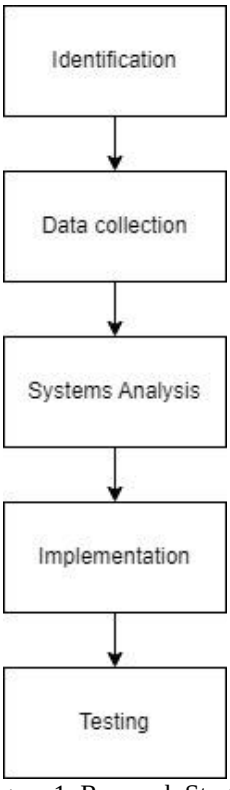


Figure 1. Research Stages

The diagram above illustrates several stages of research, including problem identification, data collection, system analysis, implementation, and testing. Problem identification involves defining the research problem to be addressed or solved. Following this, data collection is conducted using various methods such as location surveys. The implementation stage entails detailed planning on how the program will be executed, encompassing the development of schedules, resource allocation, role, and responsibility identification, and setting up an implementation framework. The testing stage, conducted post-implementation, involves preparing a testing environment that includes setting up necessary hardware, software, and infrastructure.

2.2. Development Methodology

The software development method employed is the Waterfall model. This method follows a sequential phase approach, where each stage must be completed before moving to the next. The Waterfall method comprises five stages:

1) Requirement Analysis
   This step involves intensive data collection through research, interviews, and literature study to specify software requirements and understand what users need [12]. In requirement analysis, researchers will gather various elements including user needs, system requirements, and the design of the proposed system [13]. This phase results in a document specifying user requirements, which will guide the development of the system using a programming language.
2) System Design
   This stage focuses on creating the software program's design, including user interface design, data structure, and coding [14]. System design is where the researcher formulates a system plan based on the initial analysis. The design aims to facilitate user understanding of the application's appearance and functionality [15]. A good system design meets user needs and predefined system requirements, offering insights into data and control flow, functional flow, operational behavior, and information content. This includes extensive process modeling, data modeling, and interface design. A quality system design is achieved using Unified Modeling Language (UML).
3) Implementation
   The previously developed design is actualized into a functioning system during this phase. Coding or implementation is when a programmer creates the system as per the design and user specifications. Computers or laptops play a crucial role in system development. Once the system is built, the next stage involves testing the program or system to avoid errors or discrepancies with the design plan. The programming language used in the system is Kotlin, supported by the Android Studio application.
4) Program Testing
   In this phase, programmers ensure that all developed software functions correctly and produces the desired output. If deficiencies are found, they work to minimize bugs in the program. Testing is conducted progressively from the initial design and system development stages to yield a well-functioning system.
5) Support and Maintenance
   The final stage allows for revisiting the analysis through development processes to correct previously undetected errors in the testing phase. Once the software is operational and used by the end-users, maintenance is conducted. System maintenance typically includes error correction, implementation unit improvements, user interface adjustments, and updates to meet evolving needs.

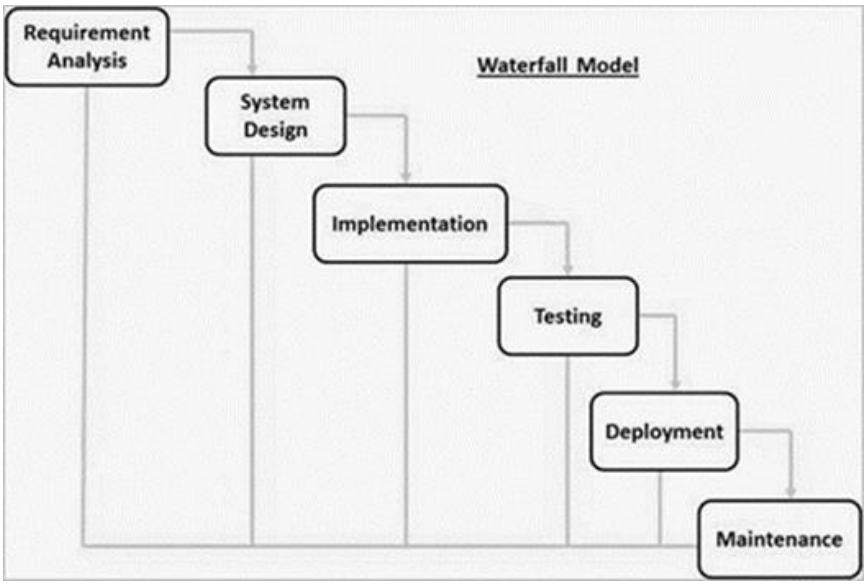


Figure 2. System Development Life Cycle (SDLC) Waterfall.

3. Result and Discussion

3.1 Results
3.1.1 System Design Stages
1) System Analysis
At this stage, the author identifies the needs and objectives to achieve implementation. System analysis requires two types of requirements: functional and non-functional. Functional requirements include input needs, process needs, and output needs. Meanwhile, non-functional requirements entail software and hardware to implement the application.

2) Design Flowchart
The flowchart represents the user's application flow from starting the application to successfully registering and viewing blood stock.

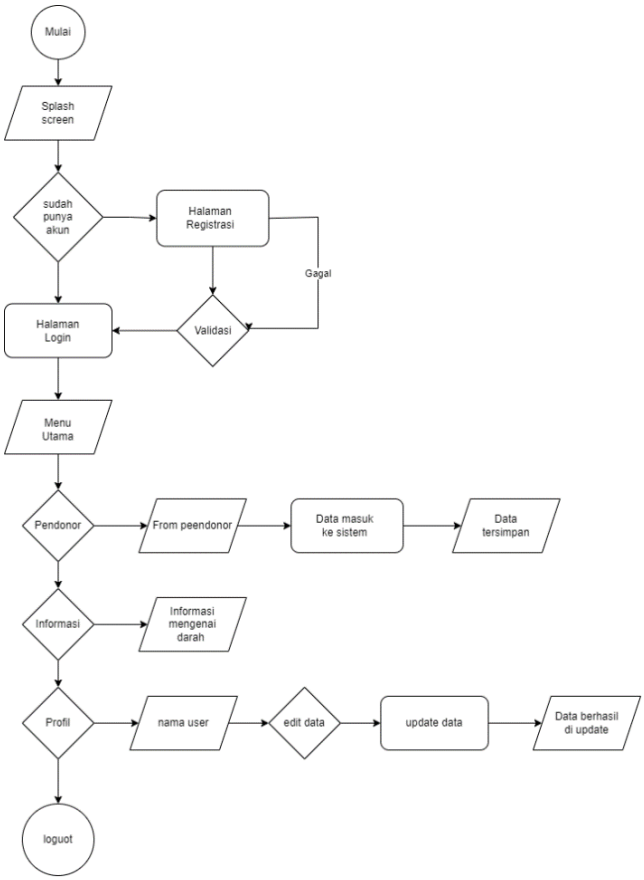


Figure 3. Flowchart

3) Use Case Diagram
The use case diagram is used to depict the interaction between the user and the system, explaining system functionalities, understanding user requirements, and documenting the system.

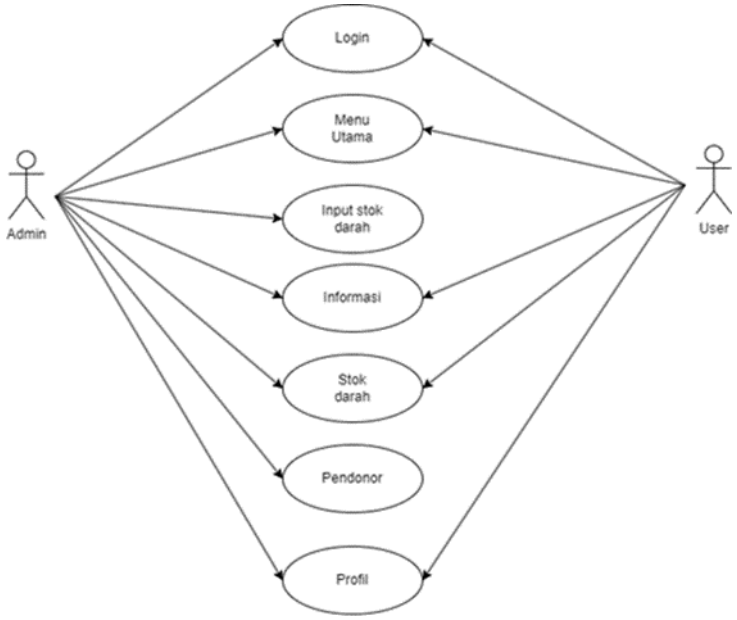
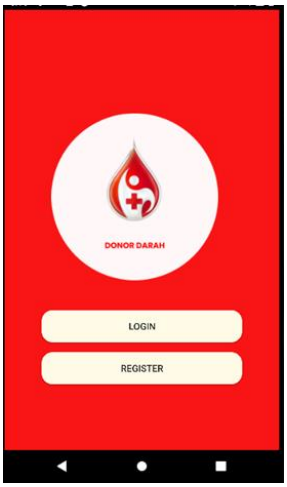
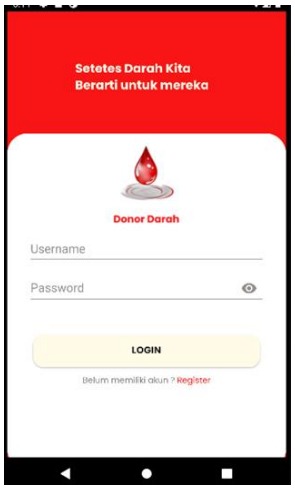


Figure 4. Use Case Diagram

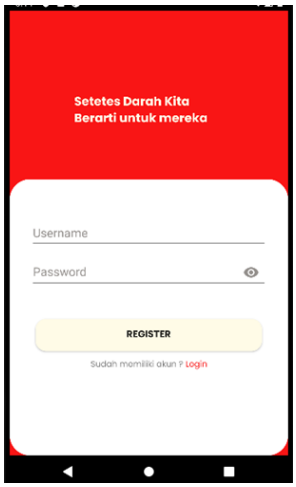
3.1.2. Implementation



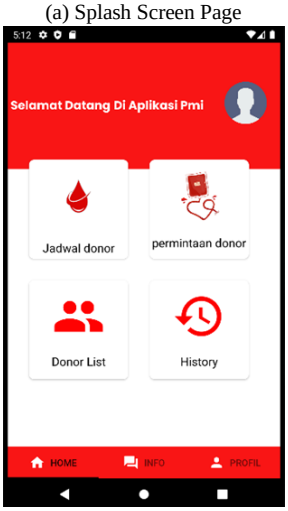
(a) Splash Screen Page



(b) Login Page Display

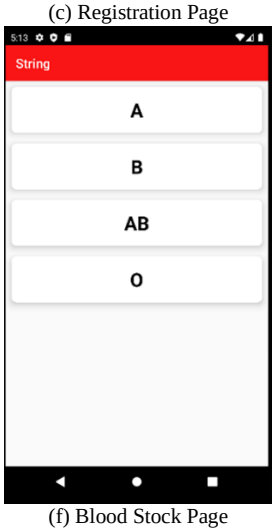


(c) Registration Page



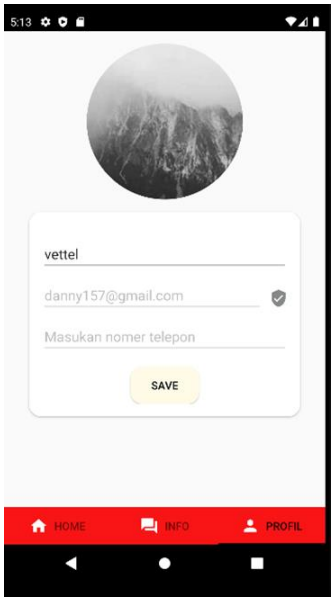
(d) Home Page

(e) Donor Registration Page



(f) Blood Stock Page

(g) Information Page



(h) Profile Page

Figure 5. App View

The splash page is the first page visited by users, where they can register an account or enter an existing one (figure 5.a). On the login page, application users can enter the application if they have an account by providing an email and password (figure 5.b). If a user does not have an account to log in, they will be directed to the registration page (figure 5.c). This page serves as the main feature where users can donate their blood, request a donor, view the donor list, and history of activities (figure 5.d). The Donor Registration page is for self-nominating as a blood donor (figure 5.e). The Donor List page functions to see who has donated blood (figure 5.f). The information page provides knowledge about the importance of blood donation, current events, and more. On the profile page, users can change their name, email, and phone number (figure 5.g). This page allows users to be contacted to inquire if they are willing to donate blood or need a donor (figure 5.h). These app views collectively enhance the user experience by streamlining the process of blood donation and management within the application.

3.2 Discussion

The evolution of technology has brought significant advances in information systems, which have had a major impact on public health services, especially in the Indonesian Red Cross (PMI). The development of an Android-based blood donation application, as documented in this study, represents a major leap in addressing the identified efficiency and accessibility challenges. The sequential approach of the Waterfall model, detailed in the research method, lays a strong foundation for application development. Each phase, from requirements analysis to system design, implementation, and testing, is carried out carefully to ensure application functionality is aligned with user needs and system requirements. By using Unified Modeling Language (UML) for system design, this research provides clarity and precision in developing user-friendly interfaces, an important aspect highlighted as a requirement for effective service delivery. The results displayed in the app view (Figure 5) demonstrate a well-thought-out user journey, from the splash screen to the profile page. Each interface, designed with user-friendliness in mind, addresses key issues of information dissemination and manual data entry processes that previously hampered efficient blood donation management. The inclusion of a donor registration page and blood stock page directly addresses the need to simplify the donation process and provide real-time blood availability information, thereby facilitating decision making and immediate action, which can save lives. Additionally, information pages and profile pages (Figures 5.g and 5.h) serve to educate users and enable personal data updates, reflecting the app's holistic approach to user engagement and interaction. These features not only foster an informed community but also enable a two-way communication channel between PMI and potential donors, addressing the challenge of reaching the technologically savvy younger generation. The results of implementing this application are multifaceted. This program promises to improve the quality of PMI services by simplifying the blood donation process, increasing access to information, and reducing the administrative burden on staff and donors. Additionally, by leveraging the power of mobile technology, the app is in line with current digital trends, increasing the likelihood of engagement from a wider audience. This research and the resulting application stand as a testament to the potential of technology in transforming public health services. By addressing the specific needs of blood donation processes through a user-centric application, the PMI is poised to improve its operational efficiency and service quality. As the application is adopted and utilized, it is expected to yield significant benefits for both PMI and the community, underpinning the crucial role of technology in healthcare advancement.

4. Related Work

The intersection of technology and healthcare has been a subject of extensive research, particularly in the context of improving the efficacy of public health services through information systems. The body of related work encompasses various studies and applications that aim to address challenges like those tackled by the Indonesian Red Cross (PMI) in managing blood donation processes. Several studies have focused on the development of e-Health systems, which provide digital solutions for healthcare services. For example, research on electronic health records (EHR) demonstrates the potential to streamline patient information management, improving the quality of care and facilitating better health outcomes. Similarly, mobile health (mHealth) applications have been developed to improve accessibility to healthcare services, allowing patients and healthcare providers to interact remotely. These applications often include features for tracking health indicators, medication reminders, and providing health education, which align with the functionalities of the proposed blood donation application. In the domain of blood donation, various systems have been implemented around the world. Mobile apps like the American Red Cross Blood Donor App and the UK's NHS Give Blood app have successfully integrated functionalities for locating blood donation events, scheduling appointments, and providing donation guidelines. These applications serve as benchmarks for the PMI's application, showcasing the benefits of such systems in enhancing donor engagement and retention.

The scholarly landscape surrounding healthcare information systems, particularly within blood donation management, is rich with contributions that align with and inform the current research on developing an Android-based application for the Indonesian Red Cross (PMI). Studies such as those by A. Rizka Silvia *et al*. (2023) and H. Setyawan and P. Pahlevi Pasha (2022) have laid groundwork in web and mobile application realms, focusing on streamlining registration and donor management processes. This body of work signifies the critical role that digital solutions play in enhancing the efficiency and reach of blood donation services [1][2]. Furthering this narrative, D. Ratna Sari Pohan and M. Barkah Akbar (2021) examined the potential of self-service technologies in blood donation, offering insights into the autonomy and convenience such applications can afford donors [3]. Their research echoes the user-centric design principles that are integral to the PMI application. Similarly, the UI/UX-focused work of A. Wardiyanto *et al*. (2019) underscores the importance of intuitive design in fostering user engagement, a core objective of the PMI app's development strategy [4].

The functionality of information systems in emergency response is exemplified by F. Almu'iini Ahda *et al*. (2020), while H. Dzulfahmi *et al*. (2018) highlight the broader applications of such systems in disseminating critical healthcare information. These studies contribute to a comprehensive understanding of how digital platforms can serve various healthcare needs, from emergency situations to educational outreach [8][9]. The Waterfall model's relevance and efficacy in system development are well-documented across multiple research efforts, including those by N. Hidayati (2019), H. Hermansyah *et al*. (2022), and A. T. Herdiansyah *et al*. (2021). The structured approach of the Waterfall model, favored for its systematic progression from conception to maintenance, mirrors the methodology employed in the current PMI app project [12][13][14].

Moreover, research has delved into the use of social media and digital platforms to reach younger demographics, who are typically less represented in blood donation statistics. These studies suggest that targeted campaigns on social media can raise awareness and encourage participation in blood donation activities among younger populations. Another relevant area of work is the application of data analytics in predicting blood supply and demand, which is critical for maintaining balance in blood banks. Predictive models using historical data and trends can provide insights into future needs, helping organizations like the PMI to plan and optimize blood donation drives. The design and implementation of user-centered health information systems have also been explored, emphasizing the importance of usability and user experience in encouraging the adoption of such systems. Research in this area often involves gathering user requirements through surveys and interviews, much like the requirements analysis phase in the Waterfall model used for the PMI application.

5. Conclusion

Based on the research, it can be concluded that the lack of disseminated information causes blood donation activities to be less attractive to the public, so they want to participate. Therefore, the results of the author's research at PMI Gunung Kidul Regency and regarding the creation of the system, it can be concluded that the integrated service system is based on Android This can optimize data services so that they are well managed because they are already stored in the database and make it easier to search for data. With this application, it is hoped that it can help speed up the process that has been created for PMI and the public who want to register blood donors and can help them find out information on blood stock data that is still available at PMI Gunungkidul district. This blood donation application also has a simple appearance which can make the application's performance does not take up a lot of RAM. However, due to the author's limited time, the application design is less attractive and less than optimal. It is hoped that the development of this application can develop better security. so that the data in this application is more secure so that it is not misused by other people. And the lack of this application needs to be published on the Google Play Store to make it easier for people to download this application. Apart from the conclusions above, this researcher can also provide tools that will be useful in the future for other parties who will continue the development of this research.

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