

Development of an Android-Based Healthcare System

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ABSTRACT – The development of information technology plays an important role in supporting public health services, including Posyandu activities. At Posyandu ILP Kutilang, Rambang Senuling Village, data recording is still conducted manually, resulting in delays in data recapitulation and report preparation, as well as suboptimal information management. This study aims to develop an Android-based health service system that supports the integrated recording, monitoring, and reporting of Posyandu data. The system was developed using the Rapid Application Development (RAD) method, which consists of the requirements planning, user design, construction, and cutover stages. Data were collected through observation, interviews, documentation, and literature review. The developed system provides three access roles, namely Posyandu cadres, community members, and the Head of the Community Health Center, with features for participant data management, health examination recording, registration, Posyandu scheduling, health history, health development graphs, and reporting. Testing using the Black Box Testing method showed that the tested functions operated according to the expected results. The results indicate that the developed system provides features to support Posyandu data management and health service activities according to the identified requirements.

Keywords - Android Application, Information System, Posyandu.

Pengembangan Sistem Layanan Kesehatan Berbasis Android

ABSTRAK – Perkembangan teknologi informasi berperan penting dalam mendukung pelayanan kesehatan masyarakat, termasuk kegiatan Posyandu. Pada Posyandu ILP Kutilang, Desa Rambang Senuling, pencatatan data masih dilakukan secara manual sehingga menyebabkan keterlambatan dalam rekapitulasi data dan penyusunan laporan, serta pengelolaan informasi yang belum optimal. Penelitian ini bertujuan untuk mengembangkan sistem pelayanan kesehatan berbasis Android yang mendukung pencatatan, pemantauan, dan pelaporan data Posyandu secara terintegrasi. Sistem dikembangkan menggunakan metode Rapid Application Development (RAD), yang terdiri dari tahapan requirements planning, user design, construction, dan cutover. Pengumpulan data dilakukan melalui observasi, wawancara, dokumentasi, dan studi pustaka. Sistem yang dikembangkan menyediakan tiga hak akses, yaitu kader Posyandu, masyarakat, dan Kepala Puskesmas, dengan fitur pengelolaan data peserta, pencatatan pemeriksaan kesehatan, pendaftaran, penjadwalan Posyandu, riwayat kesehatan, grafik perkembangan kesehatan, dan pelaporan. Pengujian menggunakan metode Black Box Testing menunjukkan bahwa fungsi-fungsi yang diuji berjalan sesuai dengan hasil yang diharapkan. Hasil penelitian menunjukkan bahwa sistem yang dikembangkan menyediakan fitur untuk mendukung pengelolaan data Posyandu dan kegiatan pelayanan kesehatan sesuai dengan kebutuhan yang telah diidentifikasi.

Kata Kunci – Aplikasi Android, Posyandu, Sistem Informasi.

1. INTRODUCTION

The development of information technology has had a significant impact on various aspects of life, including the healthcare sector. The utilization of digital technology can support the improvement of

healthcare service quality and efficiency through more structured processes for recording, managing, monitoring, and reporting data. Digital transformation in healthcare services can also help accelerate service delivery, improve the accuracy of medical data, expand access to information, and

support more integrated data recording and reporting [1].

One form of community-based healthcare service that requires systematic data management is the Integrated Healthcare Center (Pos Pelayanan Terpadu or Posyandu). Posyandu is a community-based healthcare facility that plays an important role in meeting the healthcare needs of the community, ranging from infants to older adults. Posyandu services cover various activities, including maternal and child health, nutritional monitoring, immunization, and other basic healthcare services. Therefore, the management of participant data and Posyandu service records is an important aspect of supporting the health monitoring process within the community.

The implementation of information technology in Posyandu activities has been explored in various studies. An Android-based Posyandu information system was developed in Plumbon Village, Indramayu, to facilitate participant data collection, health development monitoring, and digital data reporting [2]. An Android-based Posyandu service information system was developed in Tangki Village, West Jakarta, to support the management of Posyandu service data [3]. A mobile health application was also developed to support primary healthcare facilities through pregnancy monitoring, educational features, emergency notifications, and examination history [4]. Meanwhile, an Android-based healthcare service application was developed at Maros Baru Community Health Center to support patient registration and healthcare service data management [5].

Other studies have also demonstrated the use of digital applications for Posyandu health monitoring. The M-Posyandu application was examined for its effectiveness in supporting the early detection of nutritional problems among children under five through data management, recording, counseling, and the delivery of information accessible to authorized parties [6]. In addition, an Android-based periodic immunization data monitoring application was developed using the Rapid Application Development (RAD) method to support Posyandu monitoring and service processes [7].

These studies demonstrate that the utilization of digital applications can support the recording, management, and monitoring of healthcare data. However, existing studies generally focus on specific Posyandu functions, such as participant data management, healthcare service registration, nutritional problem detection, or periodic immunization monitoring. Therefore, this study contributes an Android-based system that integrates multiple Posyandu service functions within a single system and provides role-based access for Posyandu cadres, community members, and the Head of the

Community Health Center.

This condition differs from the situation identified at Posyandu ILP Kutilang, Rambang Senuling Village. Based on the research findings, the recording and reporting of Posyandu activities are still conducted manually using notebooks and reporting sheets. This condition results in less structured data and may lead to recording errors, such as incorrect name entries and mismatched participant data. In addition, manual recapitulation causes delays in submitting reports to the community health center. Reports that should be submitted within 1–2 days after the activity may be delayed for up to 4 days to one week. This condition may hinder the delivery of health information and the monitoring process conducted by the community health center.

Based on these problems, there is a need for a system that not only digitizes participant data recording but also integrates participant registration, service data management, examination records, health histories, health development charts, Posyandu activity schedules, and reporting to the community health center. The developed system involves three groups of users, namely Posyandu cadres, community members, and the head of the community health center. Cadres can manage participant data and examination results, community members can register and access schedules and health histories, while the head of the community health center can monitor Posyandu data and activity reports.

Therefore, the development of an Android-based healthcare service system at Posyandu ILP Kutilang is intended to provide a platform for digital and integrated data management. The system provides facilities for recording and managing Posyandu data, reporting activities to the community health center, and monitoring participants health development across different age groups.

Based on the aforementioned description, this study aims to develop an Android-based healthcare service system capable of supporting structured health data recording for Posyandu participants, accelerating the recording and reporting of Posyandu activities to the community health center, and providing health development charts and health history monitoring features for participants, including children under five, adolescents, pregnant women, and older adults.

2. LITERATURE REVIEW

1. Healthcare Service System

A healthcare service system is an organized effort carried out individually or collectively within an organization to maintain and improve health, prevent and treat diseases, and restore the health of individuals, families, groups, or communities [8]. A

healthcare service system consists of interconnected components, including inputs, processes, outputs, impacts, and feedback, which support the delivery of healthcare services to the community [9]. Therefore, a healthcare service system can be understood as an integrated system that supports the delivery and management of healthcare services through interconnected resources, processes, and information.

In the context of Posyandu services, a healthcare service system can support the management of participant data, health service records, examination results, health histories, and reporting activities. The implementation of a digital system can facilitate more structured data management and support the monitoring of participant health conditions.

2. Posyandu Integrasi Layanan Primer

Posyandu Integrasi Layanan Primer (ILP) is a community-based healthcare service that aims to meet the healthcare needs of the community across different age groups, from infants to older adults [10]. Posyandu also functions as a community-based platform for healthcare services and communication, supported by healthcare personnel and technical guidance [11].

The broad scope of Posyandu ILP services requires systematic management of participant and healthcare data. Data recording, examination monitoring, health history management, and reporting are important components in supporting continuous healthcare services. Therefore, the utilization of an information system can provide support for managing Posyandu activities and organizing health-related information more effectively.

3. Android-Based Application

Android is a Linux-based operating system developed by Google for mobile and touchscreen devices. Its open-source characteristics allow developers to develop and utilize various applications according to user and system requirements [12]. Android applications can therefore be utilized as a medium for delivering digital services through mobile devices.

In healthcare services, Android-based applications can support the digitalization of service processes and facilitate healthcare data management. An Android-based Posyandu information system has been developed to support participant data collection, health monitoring, and digital reporting [2]. These findings indicate that Android-based applications are relevant for supporting digital healthcare services at the community level.

4. Rapid Application Development

Rapid Application Development (RAD) is a

software development method that emphasizes a relatively short development cycle and accelerated system development [13]. RAD supports an iterative development process that allows system requirements and designs to be developed and refined according to user needs [14].

The RAD method is appropriate for applications that require rapid development and direct user involvement. In this study, the development process involves identifying user requirements, designing the system, developing the application, and implementing the resulting system. User involvement is important because the developed system must accommodate the needs of Posyandu cadres, community members, and the head of the community health center.

Based on these concepts, the development of an Android-based healthcare service system using the RAD method is expected to provide an integrated platform for managing Posyandu participant data, healthcare service records, health histories, health development monitoring, and activity reporting. The combination of an Android-based platform and the RAD development approach is therefore aligned with the need for an accessible healthcare service system that can be developed efficiently according to user requirements.

3. RESEARCH METHODS

This study uses a descriptive research method with a qualitative approach. The descriptive method is used to describe the conditions and phenomena occurring in the research object based on the facts found in the field [15]. The qualitative approach is used to obtain information from respondents as research subjects in order to obtain a holistic understanding of the conditions being studied [16]. The primary data in this study were obtained directly from Ibu Isma Yanti as the Head of Posyandu ILP Kutilang, Rambang Senuling Village, while secondary data were obtained through literature studies, including books, e-books, scientific journals, and previous studies relevant to the research [17].

In this study, the descriptive qualitative approach was used to identify and describe the conditions and user requirements at Posyandu ILP Kutilang. The information obtained through observation and interviews was then used as a basis for determining the system requirements in the requirements planning stage of the RAD method.

1. Data Collection Technique

Data collection was conducted to obtain accurate and relevant information regarding the conditions and healthcare service activities at Posyandu ILP Kutilang. The techniques used in this study consisted of observation, interviews, documentation, and literature study [17].

Observation was conducted by directly examining the healthcare service process at Posyandu ILP Kutilang, particularly the health monitoring activities, service flow, and data recording process. The observation showed that participant data recording was still conducted manually and data recapitulation was often delayed. These findings became the basis for identifying system requirements and developing an Android-based healthcare service system [18].

Interviews were conducted with Ibu Isma Yanti as the informant to obtain information regarding the Posyandu service flow, participant data recording process, and problems encountered during health monitoring activities. The information obtained from the interviews was used as a basis for determining the system features and design needed to support the management of participant health data [18].

Documentation was conducted by collecting supporting materials related to the research object, including activity photographs, organizational structure, administrative records, and other relevant documents available at Posyandu ILP Kutilang. Literature study was conducted by collecting information from books, scientific journals, articles, e-books, and previous studies relevant to healthcare service system development. This technique was used to strengthen the theoretical foundation, understand health monitoring concepts, and identify appropriate methods and technologies for the development of the system [19].

2. System Development Using RAD

System development was conducted using the Rapid Application Development (RAD) method. RAD is a software development method that emphasizes a relatively short development cycle [20]. This method was selected because it supports a rapid, flexible, and iterative development process while involving users directly so that feedback can be provided throughout the system development process [7].

The findings obtained from the qualitative data collection process were used as input for the requirements planning stage and subsequently guided the design and development of the system.

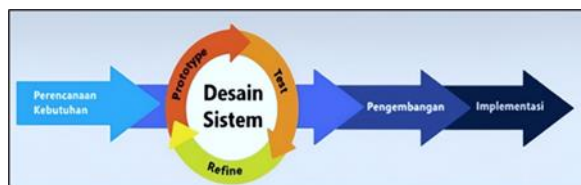


Figure 1. Rapid Application Development (RAD) Cycle

In this study, system development using RAD consisted of four stages, namely (1) requirements planning, (2) system design, (3) development, and (4)

implementation. Based on Figure 2, the RAD method applied in this study consisted of the following four stages:

- 1) Requirements Planning, this stage was conducted to identify problems and user requirements through observation and interviews. The identified requirements included participant data management, registration, health history, growth graphs, and Posyandu activity reporting.
- 2) System Design, this stage was conducted to design the system structure and workflow based on the identified requirements. The system design in this study used use case diagrams and activity diagrams to illustrate the workflow of the Android application.
- 3) Development, this stage involved implementing the system design into an Android application. The development included features for participant data management, health history, growth graphs, and reporting. If discrepancies were identified, improvements were made to the design before the development process continued.
- 4) Implementation, this stage involved implementing the developed application and conducting testing to identify errors or bugs. Improvements were made based on the testing results and user feedback before the application was used in Posyandu activities.

3. Testing Technique

The developed system was tested using Black-Box Testing. This testing technique focuses on verifying the functional requirements of the software without examining its internal code structure or program logic [21]. Testing was performed by providing inputs to the application features and comparing the expected results with the actual results displayed by the system. A feature was considered valid when the actual result corresponded to the expected result.

The testing covered the functional features of the Android-based healthcare service application, including user registration, login, participant data management, examination input, Posyandu schedules, health charts, Posyandu registration, Posyandu reports, and PDF report printing. The testing results were used to determine whether each developed feature operated according to its intended function.

4. RESULTS AND DISCUSSION

1. Results

The results of this study are in the form of an Android-based health service application developed

to support the management of Posyandu ILP Kutilang activities. The application was developed using the Rapid Application Development (RAD) method based on user requirements obtained through observation and interviews. The implementation of the application includes participant data management, recording of examination results, health development monitoring, Posyandu activity registration, schedule management, and Posyandu activity reporting.

a. Implementation of the Application Opening and Authentication Interface

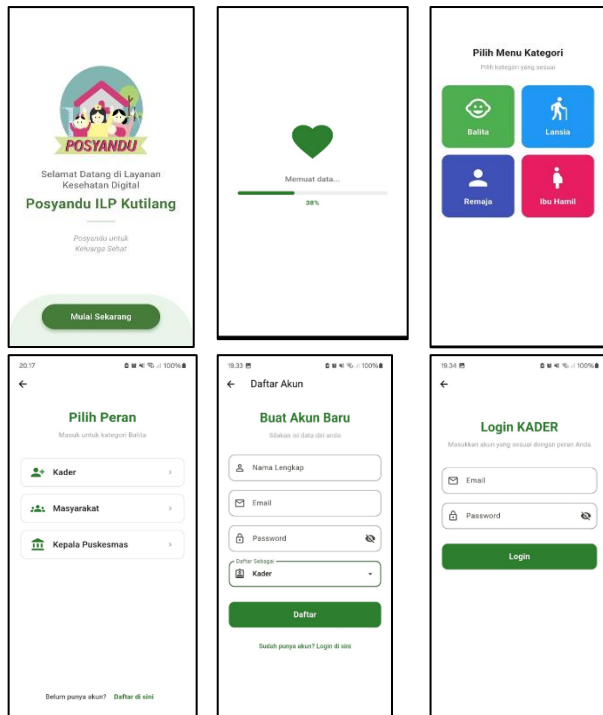


Figure 2. Application Opening and Authentication Interface

Figure 2 shows the opening interface of the application, consisting of the Splash Screen and Loading page, which serve as the initial stages before users access the services. The Splash Screen displays the application identity, including the Posyandu ILP Kutilang logo, application name, and the slogan “Posyandu untuk Keluarga Sehat”, along with the Mulai Sekarang button to proceed. Afterward, the system displays the Loading page as the process of loading data and application components until completion. The user is then directed to the Category Menu page, which provides health service options for Toddlers, Elderly, Adolescents, and Pregnant Women. After a category is selected, the system displays the Role Selection page, which provides three access roles: Cadres, Community, and Head of the Community Health Center.

On the Role Selection page, users who do not yet have an account can register through the Daftar di sini link by entering their full name, email address,

password, and user role. Successfully registered data are stored in the database, allowing users to proceed to the Login page. Users who already have an account can directly log in using their registered email address and password. The system then verifies the submitted credentials and directs users to the dashboard according to their assigned role. Through this flow, the opening and authentication process regulates user access before they use the available service features.

b. Implementation of the Posyandu Cadres Interface

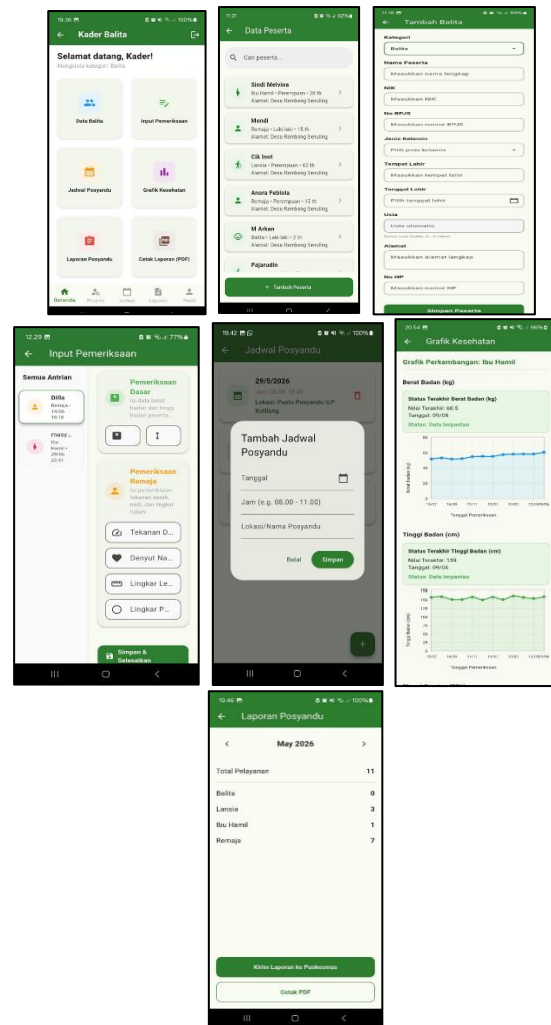


Figure 3. Posyandu Cadres Interface

The cadres interface shown in Figure 3 is designed to support the management of Posyandu activities, ranging from participant data management to monitoring and reporting service results. After successfully authenticating as a cadres, the user is directed to the cadres dashboard, which displays key information and provides access to participant management, health examination, Posyandu scheduling, health graphs, and reporting features. The participant management process begins on the Posyandu Participant Data page, which is used to view registered participant data. Cadres can add new participants through the Participant Data Input page

by entering the required information, after which the data are stored in the system for subsequent service activities.

After participant data are available, cadres can record health examination results through the Examination Input page and manage activity schedules through the Add Posyandu Schedule feature. The Posyandu scheduling feature enables activity information to be stored and accessed through the system. Digital schedule management is also consistent with the development of a database-based Posyandu scheduling system intended to support schedule management and services for participants [22]. Stored examination data can then be presented in the form of Health Graphs to assist cadres in monitoring participants' health development. All managed activity data can subsequently be used through the Posyandu Report feature to review and compile activity results. Through this series of features, the cadres interface supports data management, service recording, health monitoring, and Posyandu activity reporting within an integrated system.

c. Implementation Of the Community Interface

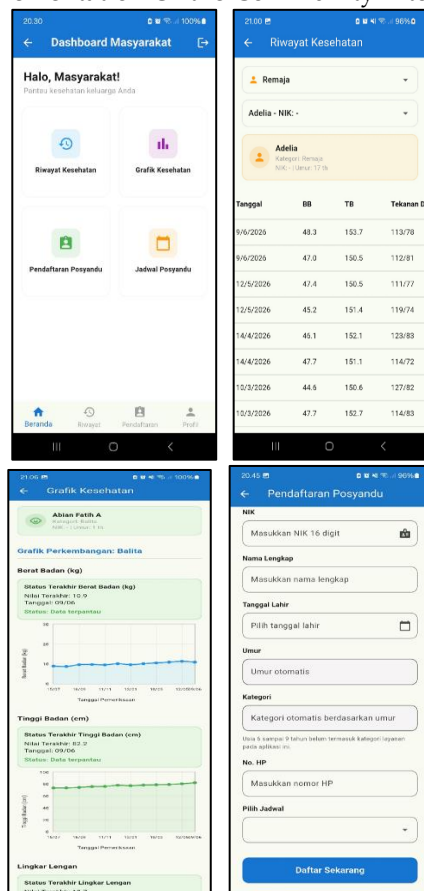


Figure 4. Community Interface

The community interface is designed as a means for users to independently access Posyandu health information and services. As shown in Figure 4, after successfully logging in as a community member, the user is directed to the Community Dashboard, which

provides access to the Health History, Health Graph, Posyandu Registration, and Posyandu Schedule features. Through the Health History feature, users can select a category and participant to view examination results stored in the system, including examination dates, body weight, height, and other health indicators according to the participant category. The data are derived from examination results recorded by cadres, allowing participants' health histories to be displayed continuously.

In addition to viewing examination histories, community members can use the Health Graph feature to monitor participants' health development based on stored examination data. Users select a category and participant, after which the system displays development graphs and the latest examination information according to the health indicators for each category. Community members can also register for Posyandu activities by entering their National Identification Number (NIK), full name, date of birth, telephone number, and available Posyandu schedule. The system automatically calculates the participant's age and determines the service category based on the date of birth, while the NIK is used as the participant's unique identifier to link registration data with previous examination histories. Successfully registered data are then stored in the database and can be used by cadres during Posyandu service activities.

d. Implementation of the Head of the Community Health Center Interface

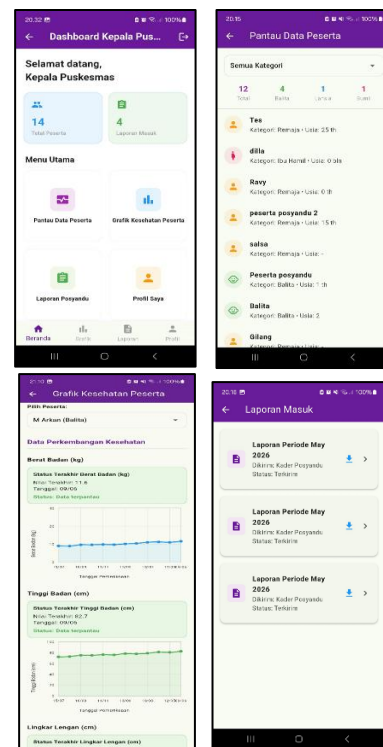


Figure 5. Head of the Community Health Center Interface

Figure 5 presents the Head of the Community Health Center interface, which is used to support the monitoring and evaluation of Posyandu activities managed by cadres. After successfully logging into the system, the user is directed to the Head of the Community Health Center Dashboard, which displays summary information regarding the number of participants and incoming reports. From this page, users can access several main features, including participant data monitoring, health development monitoring, Posyandu reports, and user profile management.

The interface flow begins with the Head of the Community Health Center Dashboard, from which users can select the Participant Data Monitoring menu to view participant data based on service categories, such as toddlers, adolescents, pregnant women, and elderly participants. Furthermore, through the Health Graph Monitoring menu, users can select a category and participant to view the development of health indicators based on examination history in graphical form. Meanwhile, the Posyandu Report menu is used to view activity reports submitted by cadres, including information on the reporting period, report sender, report status, and access to view or download the reports. Through these integrated features, the system provides the Head of the Community Health Center with access to monitor participant data, health development, and Posyandu activity reporting.

e. Functional System Testing

System testing was conducted to ensure that the main functions of the Android-based health service application operate according to the established requirements. The testing used the Black Box Testing method by evaluating system functions based on the inputs provided and the outputs generated without considering the structure of the program code. The testing covered authentication, participant data management, examination recording, schedule management, health monitoring posyandu registration, and report management.

Table 1. Results of functional system testing

No .	Tested Feature	Test Scenario	Expected Result	Actual Result	Status
1	Registration	Entering data and creating an account	Account is successfully created and verified	As expected	Valid
2	Login	Entering a valid email and password	User is logged in according to their role	As expected	Valid
3	Category & Role Selection	Selecting a category and role	System directs the user to the	As expected	Valid

No .	Tested Feature	Test Scenario	Expected Result	Actual Result	Status
			login page according to the selection		
4	Participant Data	Adding, viewing, and searching participant data	Participant data can be managed and displayed	As expected	Valid
5	Examination	Entering and saving examination results	Examination data are stored and added to the health history	As expected	Valid
6	Posyandu Schedule	Adding and deleting schedules	Schedules can be successfully managed	As expected	Valid
7	Health Graph	Selecting a participant and displaying the graph	Health development graph is displayed	As expected	Valid
8	Posyandu Registration	Entering data and selecting a schedule	Participant is successfully registered	As expected	Valid
9	Health History	Selecting a participant and viewing the history	Examination history is displayed	As expected	Valid
10	Posyandu Report	Creating, submitting, and printing a report	Report is successfully created, submitted, and printed	As expected	Valid
11	Head of Community Health Center Monitoring	Viewing participant data and health graphs	Data and graphs can be monitored	As expected	Valid
12	Incoming Reports	Opening and downloading reports	Reports submitted by cadres can be displayed and downloaded	As expected	Valid

Based on the testing results, all main application functions obtained a valid status because the actual results were consistent with the expected results. On the cadres side, participant management, examination recording, Posyandu scheduling, health

graphs, and reporting functions operated according to the design. On the community side, the registration, health history, and health graph monitoring functions could be used to access participants' health information. Meanwhile, the Head of the Community Health Center could monitor participant data, health development, and Posyandu activity reports submitted by cadres. These results indicate that the main functions of the application operate according to the user requirements and the designed system flow.

2. Discussion

The developed application integrates several Posyandu service functions, including participant data management, health examination recording, health history, health development graphs, Posyandu registration, schedule management, and activity reporting. The system also provides role-based access for cadres, community members, and the Head of the Community Health Center. The integration of these functions provides a single platform for managing Posyandu service data based on the requirements identified through observation and interviews. In practical terms, the application provides digital facilities for recording, accessing, monitoring, and reporting Posyandu service data according to the respective user roles.

The results of this study are in line with previous studies that have developed Android-based systems for Posyandu and healthcare services. Persada and Anggara (2024) developed an Android-based Posyandu information system focusing on participant data management, reporting, and healthcare services [2]. Suarayasa et al. (2022) focused on digital recording, growth monitoring, and early detection of nutritional problems [6]. Triana et al. (2021) developed an Android-based application for periodic immunization monitoring using the RAD method [7]. Compared with these studies, this study focuses on integrating several Posyandu service functions, including participant data management, examination recording, registration, scheduling, health history, health development graphs, and reporting, within a single Android-based system with role-based access for cadres, community members, and the Head of the Community Health Center.

The functional testing results show that all tested application functions obtained a valid status because the actual results were consistent with the expected results. These results demonstrate that the developed functions operate according to the designed scenarios and identified user requirements. However, the testing in this study was limited to functional correctness using Black Box Testing. Therefore, the results do not directly demonstrate improvements in usability, performance, security, compatibility across

Android devices, reliability, efficiency, accuracy, or service quality.

This limitation indicates that further evaluation is needed to assess the application from non-functional aspects. Future research can include usability evaluation to assess user experience, performance testing to evaluate application responsiveness, security testing to assess data protection, compatibility testing across different Android devices, and reliability testing to evaluate system stability during use. In addition, the system can be further developed by adding automatic notifications for Posyandu schedules, more comprehensive input validation, integration with the Puskesmas information system for faster and real-time data exchange, and enhanced data security through encryption and user access management. The application can also be expanded to other platforms, such as iOS and web, to support wider accessibility.

5. CONCLUSION

Based on the results of the study, the Android-based health service application for Posyandu ILP Kutilang, Rambang Senuling Village, was successfully developed using the Rapid Application Development (RAD) method according to user requirements. The application provides role-based access for Posyandu cadres, community members, and the Head of the Community Health Center, while supporting the digitalization of Posyandu service management, including participant registration, participant data management, examination recording, schedule management, health history and graph monitoring, as well as the preparation and submission of Posyandu reports. The results of testing using the Black Box Testing method showed that the main functions of the application operated according to the predetermined scenarios. Therefore, the developed application provides supporting features for managing and monitoring Posyandu health service data according to the tested system functions. Further development can focus on adding Posyandu activity notifications, integrating the application with the Community Health Center information system, and developing health data analysis features to support monitoring and decision-making processes.

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