The Development of a Mobile Health Application for Stunting Monitoring in Nagrak Village, Sukabumi, West Java, Indonesia : A Design Thinking Approach

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Abstract

Background: Stunting, characterized by low height-for-age, is a critical public health challenge in Nagrak Village, Sukabumi, West Java, Indonesia, primarily due to malnutrition and inadequate healthcare access. Mobile health (mHealth) applications have emerged as a promising tool to support stunting monitoring and intervention efforts. However, there is a need for a user-friendly mHealth app that is tailored to the local context and addresses the specific needs of the community.

Objective: This study aimed to explore the requirements and expectations of families and healthcare providers in Nagrak Village to inform the development of a stunting monitoring mHealth app.

Methods: Employing a 5-step design thinking approach, which includes empathy, define, ideate, prototype, and test. Focus groups and individual interviews were conducted to gather insights into the stunting issue in Nagrak Village. A thematic analysis was performed to identify the key features and functionalities desired in the app.

Results: The study identified several critical themes for the app, including growth tracking, nutritional guidance, healthcare access, educational content, community support, and data management. Participants expressed a need for an app that is easy to use, culturally appropriate, and provides reliable informatiThe design thinking approach facilitated a user-centered and culturally sensitive development process for the mHealth app. The insights gained from each step of the approach were instrumental in bridging the gap between the app developers and the end-users. on under professional guidance.

Conclusions: The design thinking approach facilitated a user-centered and culturally sensitive development process for the mHealth app. The insights gained from each step of the approach were instrumental in bridging the gap between the app developers and the end-users.

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Keywords: Stunting; mHealth; Nagrak; Design Thinkink; Public Health

Introduction

Globally, stunting—defined as stunting—is a serious public health concern. It is mostly caused by malnutrition and recurring illnesses. According to the World Health Organisation (WHO), stunting, which results from chronic undernutrition throughout the most crucial stages of early life growth and development, affects about 22% of children under five worldwide 1. The Indonesian Basic Health Research (RISKESDAS) indicates that over 30% of children under five are affected by stunting, which is still frighteningly common in the country 2. In rural regions like Nagrak Village, Sukabumi, where access to healthcare and nutritional education may be restricted, this issue is especially urgent.

In Sukabumi Regency, West Java, the stunting rate is the second highest in the West Java province, with Nagrak Subdistrict reporting 345 cases across 10 villages .The socio-economic conditions in Nagrak Subdistrict, where the average family income ranges from IDR 30,000 to IDR 50,000 per day (or IDR 900,000 to IDR 1,500,000 per month), significantly influence the food security of families. The main occupations are daily laborers, farmers, and factory workers. These conditions, coupled with rising food prices, could lead to stunting in children 3.

In response to the stunting issue, the Sukabumi Regency Government has initiated an innovative program called GADIS (Action Movement for Detection and Intervention of Stunting) to support the West Java policy of Jabar Zero New Stunting 2023. The program aims to accelerate the reduction of stunting rates and prevent new cases, with the goal of achieving Zero Stunting by 2024 4. However,

despite these efforts, there are still challenges in managing and monitoring stunting cases. For instance, about 45% of mothers are workers, making it difficult for them to fully breastfeed their babies. Moreover, many families live with their parents, leading to situations where the child's care is transferred to the grandparents while the parents work. This situation often results in a lack of awareness and knowledge about nutrition and stunting among the caregivers.

Given these challenges, there is a need for a solution that can help monitor and manage stunting cases more effectively. A mobile health (mHealth) application could be a potential solution. mHealth applications have been increasingly used in healthcare for various purposes, including disease management, health promotion, and patient education 5.In the context of stunting, an mHealth application could provide several benefits. First, it could provide a platform for health workers to monitor the growth and development of children and identify those at risk of stunting. Second, it could provide educational materials and resources to parents and caregivers about proper nutrition and stunting prevention. Third, it could facilitate communication between health workers and families, allowing for timely intervention when needed.

The academic paper titled "The Development of a Mobile Health Application for Stunting Monitoring in Nagrak Village, Sukabumi West Java, Indonesia: A Design Thinking Approach" aims to conceptualise and provide a detailed account of the development process of a mobile health application specifically designed for monitoring child stunting in Nagrak Village, Sukabumi. This study focuses on the implementation of a design thinking method to develop an application that is user-centric and culturally fit. The application attempts to address the specific health issues related to child stunting in a rural environment. Moreover, the application aims to offer a comprehensive dashboard for stakeholders. The dashboard will provide useful insights and actionable data, allowing stakeholders to make informed choices and implement successful interventions for preventing and managing stunting in the community.

Methods

Study Design

The development of the mHealth application will be guided by a design thinking approach. Design thinking is a type of creative problem-solving that emphasizes innovation and a human-centered approach. It involves understanding the needs and challenges of the end-users, ideating potential solutions, creating prototypes, and testing and refining the solutions based on feedback. The design thinking approach consists of five steps: empathy, define, ideate, prototype, and test. The Hasso-Plattner Institute of Design at Stanford (d.school) developed this model 6.

In the context of the mHealth application for stunting monitoring, the design thinking approach will involve understanding the needs and challenges of the health workers, parents, and caregivers in Nagrak Subdistrict. It will also involve ideating and creating features that can address these needs and challenges, such as growth monitoring tools, educational resources, and communication features. The application will then be tested and refined based on feedback from the end-users. In conclusion, the development of a mobile health application for stunting monitoring in Nagrak, Sukabumi, using a design thinking approach, could potentially provide an effective solution to the stunting issue in the area. It could help health workers monitor and manage stunting cases more effectively, provide parents and caregivers with the knowledge and resources they need to prevent stunting, and ultimately contribute to the goal of achieving Zero Stunting by 2024.

The steps in implementing design thinking are:

Steps	Description of concepts	Methodologies
1) Emphatize	This stage begins with understanding the application users, namely health cadres who will use the stunting monitoring application. The development team conduct research to understand the needs and experiences of health cadres in monitoring stunting in their coverage areas. How about the families?	• Seek to understand • Conduct Focus group discussion with Babinsa, Camat, 2 Puskesmas, Ibu-ibu PKK • Emphaty by asking “need for monitor stunting in Nagrak Area”
2) Define	After understanding the users, the development team define the problems that the stunting monitoring application aims to solve. This stage involves synthesizing the collected information and determining the core problems to be addressed, such as the lack of stunting monitoring maps and insufficient healthcare personnel.	• Brainstorming by asking “the needs for monitor stunting in Nagrak area” • Name and prioritize the needs
3) Ideate	In this stage, the development team generates many solution ideas for the defined problems. This process involves creative and innovative thinking to find the right solutions for health cadres. One possible solution is a stunting monitoring application that is easy to use and can assist health cadres in monitoring stunting in their coverage areas.	• Sketch the mockups of the app on web-based cardboards • Demonstrate how to use the app
4) Prototype	This stage involves creating a prototype of the stunting monitoring application. The development team creates a small-scale version of the application to test the generated solutions. The prototype can be shared and tested with health cadres to obtain feedback.	• Develop the mockups to a native version
5) Test	The final stage is comprehensive testing of the application. The development team tests the prototype with health cadres to evaluate whether the application can solve the defined problems. This stage helps to gain insights that can be used to improve the prototype or even return to the Define stage to redefine the problems.	• Provide the simulation app for trial use

We have conducted research utilizing a five-stage design thinking methodology, as illustrated in Table 1. The initial phase involved a focus group discussion, attended by several Village Chiefs, Community Health Center Doctors, Posyandu officers, housewives who have stunted children, and agricultural instructors who designed three concurrent focus groups in the District Office's multifunctional room (steps 1-3).

Subsequently, we entered the prototyping phase (step 4) with development and testing conducted on numerous small groups (step 5). The research group held a second visit to the District Office, attended by the District Head, Family Empowerment and Welfare (PKK), and representatives from the Community Health Center, to present the developed application. Participants were invited to use the prototype and validate it further through interviews to provide input for subsequent development.

Data Collection

Procedure: Concept and Study Activities

Step 1: Emphatize

Concept: Empathy involves the endeavor to comprehend and gain insight into people's thoughts and needs within the framework of a design challenge. Researchers aim to understand how individuals engage in activities, the reasons underlying their actions, their physical and emotional requirements, their cognitive perspectives on the world, and the aspects that hold significance for them [6].

Study Activities: To grasp the prevalence of stunting in Nagrak District, as well as the family profiles and essential information sought by community health center cadres, a comprehensive exploration was conducted. At the initiation of the focus group discussion, the community health center explained the percentage of stunting cases in Nagrak District, identified the causes of stunting, outlined the initiatives undertaken to address stunting, and evaluated the efficacy of the SIMGIZI application employed thus far. This activity facilitated researchers in the observation, visual perception, and attentive listening to the subjects' experiences.

Step 2: Define

Concept: The pivotal step in the design process serves to provide clarity and direction to the design space. The objective is to identify and prioritize key issues, which will subsequently be addressed [6].

Study Activities: Following the focus group discussion, community health center cadres were tasked with engaging in a collaborative brainstorming session centered around a single question: "How can we utilize the mHealth application to assist you in monitoring stunting cases within the Nagrak Community Health Center area?" Each identified need was meticulously documented by the researchers, and subsequently, a collective determination of priority needs was made for subsequent attention.

The SIMGIZI application lacks an output feature in the form of a map illustrating the prevalence of stunting in Nagrak District. The health center personnel are compelled to manually generate such maps, causing inconvenience. In addition to the mapping feature, essential family profile data, such as family socio-economic status and family behavior related to cleanliness and health (PHBS), is not yet available.

The absence of these features, particularly the family profile function, hinders the health center's ability to implement targeted educational interventions. Moreover, the SIMGIZI application does not grant access to village heads and parents. However, village heads are key stakeholders interested in monitoring stunting conditions in their respective villages and formulating policy interventions utilizing funds from the village budget.

The current limitations in the SIMGIZI application underscore the missed opportunities for targeted interventions and comprehensive data representation, which are crucial for effective health management and policy planning. A more inclusive and feature-rich application would better serve the diverse needs of stakeholders involved in addressing stunting in the Nagrak District.

Step 3: Ideate

Concept: The ideation step in the design process focuses on the utilization of ideas. Ideas serve as the fuel and represent a resource for constructing prototypes, ultimately enabling the implementation of innovative solutions for end-users [6].

Study Activities: Aligned with the priorities established in step 2, researchers and the development team commenced the conceptualization of the Sadana application interface. Subsequently, they demonstrated how this mockup would be employed in monitoring stunting cases.

Step 4: Prototype

Concept: The prototyping step entails the iterative creation of an artifact designed to address a question closely related to the final solution. Through prototyping, designers can engage with users, reconcile discrepancies, alleviate communication challenges, and assess ideas without incurring significant time and financial resources on programming [7].

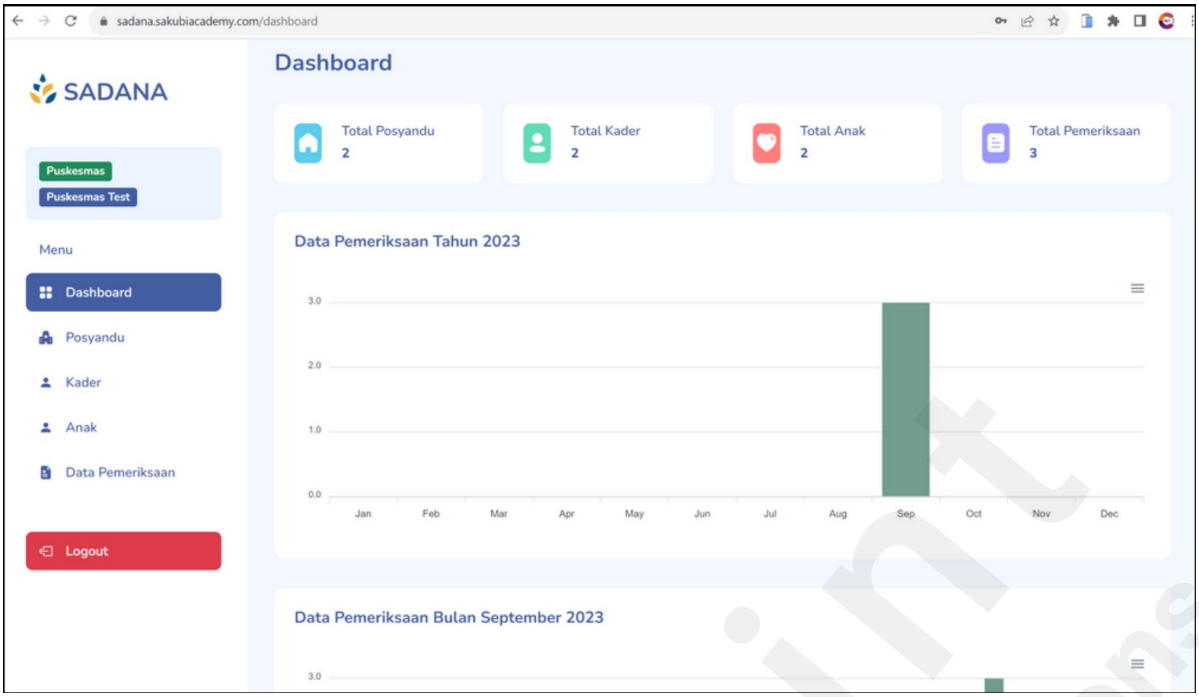
Study Activities: Drawing upon the outcomes of steps 1 to 3, researchers embarked on the development of a web-based mobile application program. This programming enables access via various computing devices, including computers and smartphones.

Step 5: Test

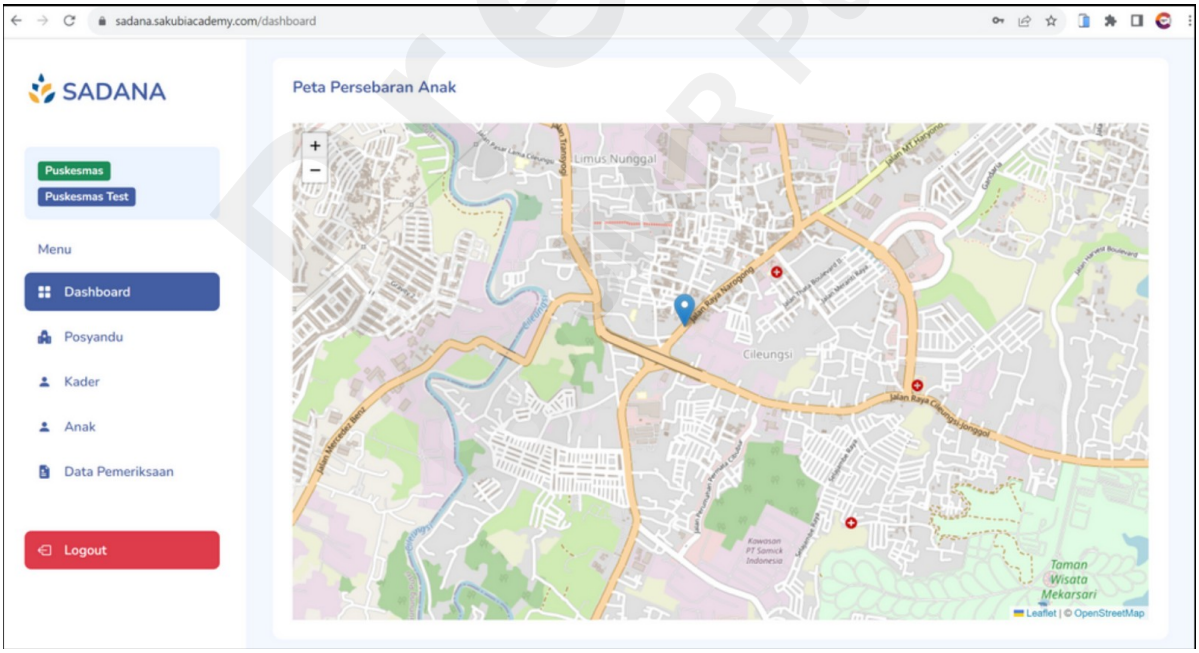
Concept: The testing phase is designed to elicit feedback from end users through the examination of a prototype. This process aids in the identification of opportunities for refinement and optimization of both prototypes and solutions [8]

Study Activities: In order to collect user input, individual interviews were conducted to simulate the Sadana application environment. Participants were presented with the simulation, and active engagement was encouraged. Subsequent to their interaction with the application, participants were posed with an open-ended question: "Please provide your recommendations for each function within this simulation app." This approach was employed to gather comprehensive feedback from each participant. Individual interviews were recorded using an audio recorder, and the recordings were subsequently transcribed for further analysis.

Results

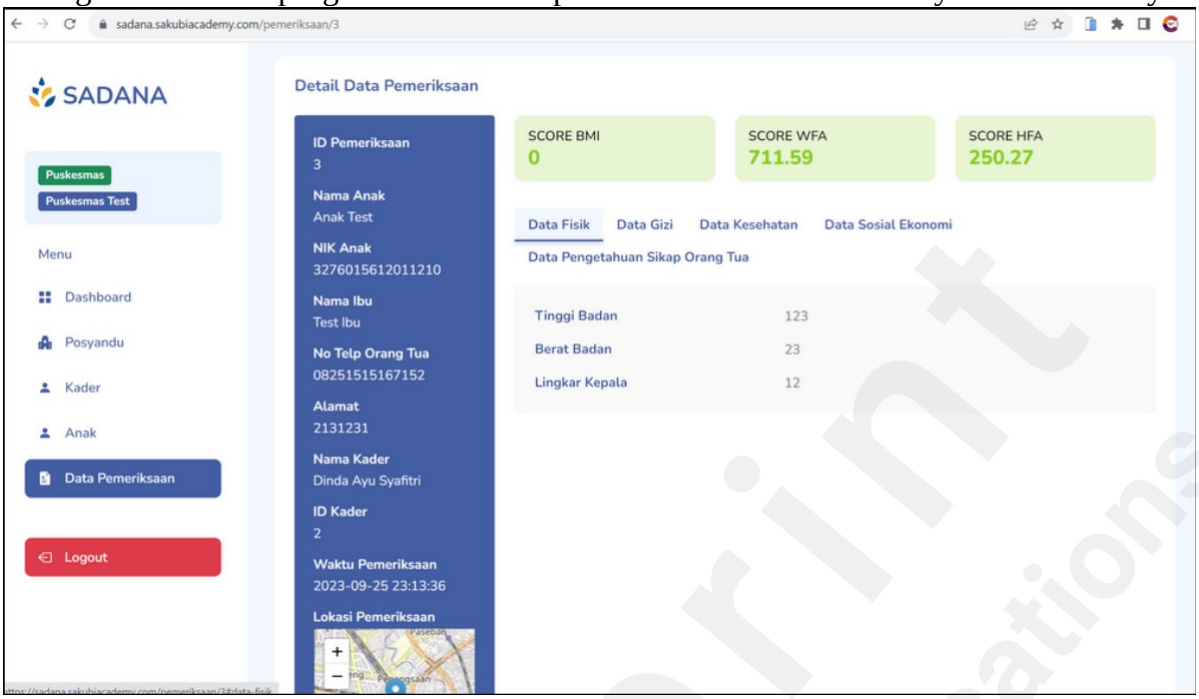


The image above represents the Sadana application utilized by the leadership of the Community Health Center (Puskesmas) and Village Head/Sub-District Head (Kepala Desa/Camat). The dashboard serves the purpose of providing information to the Puskesmas leaders and Village Head/Sub-District Head regarding various aspects of public health within their respective regions. The presented information includes the number of registered health centers, the count of registered cadres, the total number of examined toddlers, and the monthly examination figures over the course of a year. Consequently, they can monitor and evaluate the performance and progress of community health programs in their areas.



The child distribution map serves as a visual tool indicating the locations of children who have undergone examination, with their data integrated into the Sadana application. The functions of the child distribution map encompass providing a clear visualization of the spatial distribution of children, aiding in the identification of areas with high or low child populations, facilitating the monitoring of child development across various regions, assisting in the allocation of resources and

health programs for children, and enabling data-driven decision-making in the management of child health programs. By utilizing the child distribution map, the leadership of the Community Health Center (Puskesmas) and Village Head/Sub-District Head (Kepala Desa/Camat) can monitor and manage child health programs in their respective areas more effectively and sustainably.



The Detailed Examination Data feature provides more in-depth information about child examinations, including physical data, nutritional data, health data, socio-economic data, and parental knowledge and attitudes data. The functions of the Detailed Examination Data feature include offering comprehensive information about the health condition of children, encompassing various aspects such as physical, nutritional, health, socio-economic, and parental knowledge and attitudes data. It aids in identifying child health issues and determining appropriate prevention or treatment strategies. Additionally, it enables the monitoring of child development across various regions and facilitates the generation of reports on child health conditions for decision-makers.

This feature assists in the allocation of resources and health programs for children with more accurate and comprehensive information about child health conditions. It allows for data-driven decision-making in the management of child health programs based on detailed and consistent information about child examinations.

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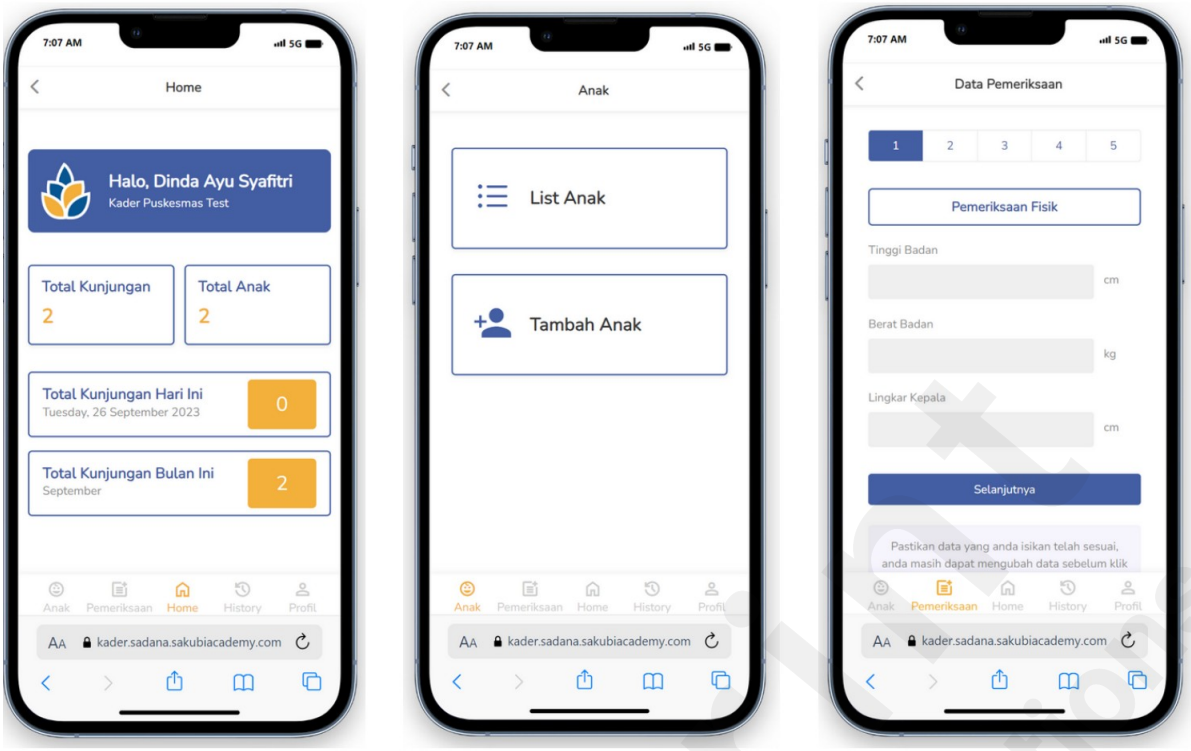

The picture above depicts the Sadana application utilized by community health workers (kader) to input examination data for children. The left image comprises features such as the count of kader visits to children's homes, the number of examined children, daily visit counts, and the monthly visit count. The middle image presents a list of children examined by the kader and an "add child" feature to include newly examined children. The right image features data input fields for physical, nutritional, health, socio-economic, and parental knowledge and attitudes data. These inputs are seamlessly connected to the Sadana Puskesmas system in real-time.

The functions of these features are to streamline the child management process, ensure accurate and consistent data, and enable community health workers to monitor and manage child health programs in their areas more effectively and sustainably.

Discussion

The first cycle of the design thinking process in the development of the Sadana application has been carried out by the researchers. The design thinking approach enables researchers to continuously refine and redesign the application based on findings from the testing phase. Design thinking is an innovation approach that emphasizes a deep understanding of users, the creation and repeated testing of prototypes, and flexibility in redesigning based on user feedback. Therefore, if findings from the testing phase indicate the need for changes or improvements, the design thinking approach allows developers to iterate and redesign the application to better meet user needs. [sumber].

The results of the testing revealed that there are features with foreign language terms such as "login," "Home," "History," "list," "previous," and "next" that need to be translated into Indonesian. Additionally, medical terms like "BMI," "WFA," "HFA," and "ID" were identified as requiring translation into Indonesian. This is because not all community health workers (kader) have a high educational background, making the use of simple and easily understandable language crucial.

Furthermore, since the Community Health Center (Puskesmas) is still required to use the SIMGIZI application, if community health workers (kader) have to input examination data into the Sadana application separately, it could be time-consuming and burdensome for them. Therefore, it would be more efficient if the examination data entered into SIMGIZI could be integrated into the Sadana application as well. This would streamline the data entry process, providing efficiency and reducing

the workload for the community health workers.

Principal Results

Limitations

One of the limitations of this research is the number of cadres who are unable to provide a stunting perspective. Our study was conducted in a rural area with fewer medical resources than urban areas of the country, and this may result in geographic bias. Time limitations in cycle one mean that cycle two cannot be carried out in this period and needs to be repeated in the next period.

Comparison with Prior Work

Conclusions

The research conducted in this study employs a design approach to develop the Sadana application, aiming to assist community health workers in consolidating child health data in their respective areas. This approach encompasses five stages: empathy, definition, ideation, prototyping, and testing. The research findings indicate that the Sadana application includes several features, such as a dashboard for the heads of Community Health Centers (Puskesmas) and Village Heads/Sub-District Heads (Lurah/Camat), a child distribution map, and a detailed examination data feature. These features enable more effective and sustainable monitoring and management of child health programs. The Sadana application also has a web-based mobile version utilized by community health workers (Kader) for inputting examination data.

The study identifies several areas for further development, including the need for the translation of foreign language terms, simplification of medical terminology, and the integration of examination data from SIMGIZI into the Sadana application. Overall, this research underscores the importance of user-focused design in developing effective health applications and emphasizes the necessity for continuous improvement based on user feedback to ensure the long-term utility of the application.

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Doctors, Nagrak Posyandu Officers, Rukun Tetangga mothers with stunting toddlers, and agricultural instructors who were involved in this research.

Conflicts of Interest

Abbreviations

Multimedia Appendix 1

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