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Transformation Of The Geographic Information System For The Distribution And Monitoring Of Stunting Children Using Epicollect5 At Nuangan Community Health Center

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ABSTRACT

In the era of rapid development of digital technology, digitalisation has become a key driver of transformation in various sectors of life. In particular, in the context of health, digitalization offers great potential to improve access, efficiency and quality of health services. On the other hand, health literacy is a critical aspect to ensure people can be optimistic about the benefits of technological developments. This research aims to build a Geographic Information System for mapping the distribution of stunting and improving the ability of cadres in handling and preventing stunting based on digital android. The research method used involved field surveys, health data collection, and the use of GIS technology to analyze the spatial distribution and risk factors for stunting. The results with this system are able to provide a geographic information system for the distribution in each sub-district and village by providing prevalence information and in handling it provides a forecasting feature for predicting the distribution of stunting in the next period, in order to anticipate the increase in stunting rates in Nuangan District. Conclusion: The process of reading data visualization on the map of spatial analysis results can help cadres and health workers in understanding stunting problems in the community.

Keywords: Health Transformation, Stunting, Posyandu Cadres, Digital, Nutritional Status

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INTRODUCTION

Stunting is a condition in which a person's height is shorter than that of others of the same age. Stunting is caused by inadequate nutrition received by the fetus or baby in the womb and during the early stages of life. The symptoms of stunting are not apparent until the child is two years old. This inadequate nutritional intake

is also caused by the mother's lack of knowledge about nutritional health before, during, and after childbirth (Verawati, 2019).

Handling stunting is one of the national development priorities listed in the 2020-2024 RPJMN with a target of reducing stunting rates by 11.8% by 2024.(Bappenas, 2015)The Indonesian Ministry of Health's primary focus in addressing stunting is providing specific nutritional interventions during the First 1,000 Days of Life (HPK). The 1,000 HPK movement is the perfect time to control/manage stunting, as this is a critical period for brain growth and development.(Crystal et al., 2018). Utilizing Posyandu as a form of community-based health efforts (UKBM) in public health services can be a strategy in stunting interventions because it focuses on pregnant women through toddlers.(Kemenkes RI, 2013).

This health change or transformation is in accordance with Law (UU) number 36 of 2009 which states that the government is responsible for planning, regulating, organizing, fostering, and supervising the implementation of equitable and affordable health efforts for the community. The health efforts referred to are every activity and/or series of activities carried out in an integrated, integrated and sustainable manner to maintain and improve the level of public health in the form of disease prevention, health promotion, disease treatment, and health recovery by the government and/or the community. Therefore, the 6 pillars of health system transformation have been established by the Ministry of Health, namely primary service transformation; referral service transformation; health resilience system transformation; health financing system transformation; health human resource transformation; and health technology transformation.

The primary care transformation aims to provide comprehensive, quality primary health care to all Indonesians, both individuals and communities. Quality primary health care is the foundation of the health care system.

The transformation of primary healthcare services focuses on three key areas: lifecycle implementation, bringing healthcare services closer through networks, and digitizing primary healthcare information systems. The Ministry of Health will revitalize Integrated Service Posts (Posyandu) to implement programs related to lifecycle implementation, serving as a platform for integrated healthcare services and strengthening promotion and prevention. Health programs at Posyandu will focus not only on mothers and infants.

The primary integrated health service post (Posyandu) program is part of the implementation of the six pillars of health transformation, specifically the first pillar of primary care transformation. The primary Posyandu program aims to maintain the health of Indonesian families. The Posyandu approach can be implemented directly with the smallest community groups, namely families. This program is considered effective because of its direct promotive and preventive health approach to each family, guided by trained cadres, thus ensuring equitable public health and well-being across all corners of Indonesia.

The less than optimal performance of integrated health service posts (Posyandu) can be seen in the proportion of KIA book records based on content for children aged 0-59 months in Indonesia in 2018 for the growth monitoring category of 57.2%; development monitoring of 45.6%; and immunization history of 69.7% (KEMENKES, 2018).This proportion is still far from the target and is not evenly distributed across Indonesia.

Based on the results of the SSGI, the prevalence of stunting in East Bolaang Mongondow Regency in 2019 was 23.9%, increasing in 2020 to 24.4% and in 2022 jumping to 30.1%, and becoming the area with the highest stunting rate in North Sulawesi.

The low capacity of cadres and lack of empowerment are the causes of the reduced function of Posyandu, so that public interest in using Posyandu as a health service is lower.(Legi et al., 2015). Cadre knowledge is very important because it can influence cadre performance in preventing stunting.(Afifa, 2019). Furthermore, cadre performance is also influenced by their motivation to participate in the integrated health post (Posyandu) program. Motivation shapes cadre character, making them more responsible in their duties and obligations.(Akintola & Chikoko, 2016).

The research interest is to support Health Transformation, especially Prime Services, in optimizing the revitalization of integrated health posts (Posyandu).to keep families in Indonesia healthy The novelty of this activity is the realization of Posyandu cadres who are responsive to stunting and other health problems based on digital Android as a unique feature that distinguishes it from other regions in handling stunting problems. The purpose of this research is to:development of a Geographic Information System for mapping the spread of stunting and improving the capabilities of cadres in handling and preventing stunting based on digital Android

METHOD

The research was conducted using the waterfall method to develop software to build a geographic information system for mapping stunting locations at the Nuangan Community Health Center. The research stages are represented in the flowchart in Figure 1.

Figure 1. Research Stage Flowchart

The research method is arranged systematically and structured so that it is easy to implement, therefore the author divides it into several stages. namely: conducting a literature study in this research, such as references from books, journals and readings that are still related to the research. Identify what problems will be discussed related to the geographic information system for mapping stunted children. Data collection is carried out to obtain information that will be needed to achieve the research objectives, this data collection process is carried out using interview and observation methods. Software system development uses the waterfall method, which consists of analysis, design, coding, testing. System Implementation This stage implements the geographic information system for mapping stunting in the Nuangan Health Center Work Area.

This research has received from the Health Polytechnic Ethics Commission of the Ministry of Health Manado Number: KEPK /01/ 03/026/2024. March 13, 2024

Geographic Information System Mapping

Analysis and design of a data management system for monitoring stunting rates is a core element in the work system of a Community Health Center (Puskesmas). As the population increases, effective and efficient management is essential. Data on malnutrition, pregnant women, and breastfeeding mothers in the Nuangan area are still being collected manually. Furthermore, there is no dissemination of information related to malnutrition statistics in the Nuangan area, making the system less effective for the community. Therefore, shifting the process of managing malnutrition data representation from manual to digital is the right move.

Development Method

The Geographic Information System for the Distribution of Stunting Rates in the Nuangan Community Health Center Work Area uses the waterfall system development method. The waterfall model itself adopts a systematic and sequential software development approach. This systematic and sequential waterfall model begins with determining customer requirements specifications, followed by the system design process based on existing customer specifications, modeling, construction, and maintenance.(Widiyawati, 2022). An overview of the waterfall method according to Pressman can be seen in Figure 2.

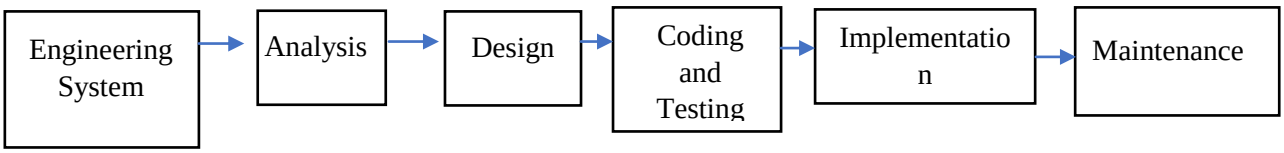

Figure 2. Figure 2 Waterfall method

Use Case Diagram

Figure 3 is a use case of the Geographic Information System for Mapping Malnutrition Figures. The use case is used to find out what functions are in a system.

Figure 3. Use Case Diagram

Inter-Table Relationship Design

A table relationship diagram is a diagram used to model the structure of a table and the possible relationships between them. It also implements an Entity Relationship Diagram, which aims to illustrate

related data in a database. Figure 3.4 shows the relationships between tables in the Geographic Information System for Mapping Malnutrition Rates in the Nuangan region.

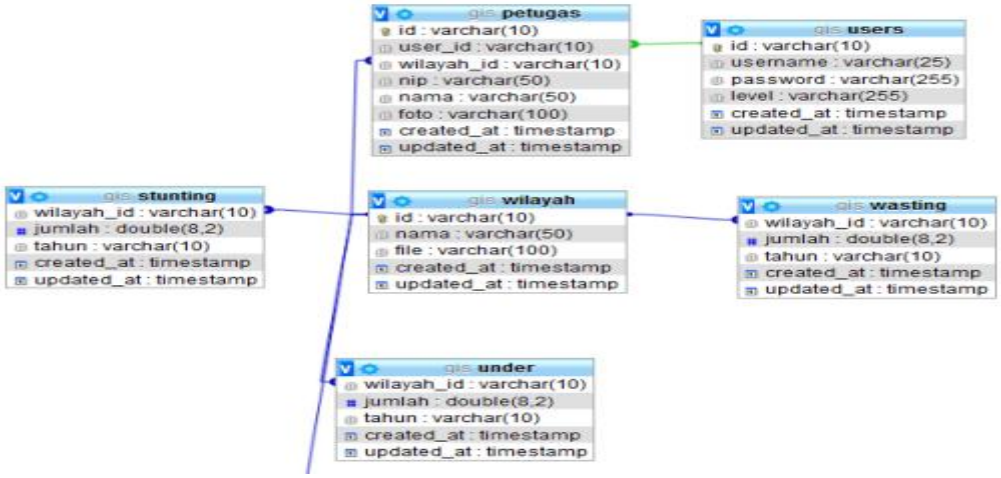

Figure 4 Relationships between tables

Research Subject

The research subjects areThe Tutuyan Community Health Center covers 10 villages and employs 35 Integrated Health Post (Posyandu) cadres. Three subjects were selected from each village, based on criteria determined by the Community Health Center. The total number of subjects was 30.

RESULTS

The research on the Digital Transformation of Posyandu Cadres in the Prevention and Handling of Stunting was conducted on May 10-13, 2023 in the hall of the Nuangan Sub-district Office, attended by 30 participants consisting of Posyandu cadres and Dashboard holders.

Participants in the training were given two days of material on stunting, dissemination of GIS-based technology mastery modules, data collection methods, and geographic information system management. The training then included one day of practical data collection and GIS input, followed by a final day of discussion on the collected data input into the GIS.

The implementation was based on the design, then efficiently implemented in a web application using the Laravel framework, which will determine whether the proposed new system is relevant. The following displays the results of the Geographic Information System for Mapping Children with Stunting and the Risk of Stunting in the Nuangan Community Health Center area.

Landing Page

The landing page is the first page displayed when the system is accessed by dashboard users, namely the Health Office, the Head of the Community Health Center, and the Sub-district Head. This landing page displays information about mapping the distribution of stunted children and those at risk of stunting in the Nuangan Community Health Center's work area. The landing page is shown in Figure 5.

Figure 5. Landing page

Login Page

The login page is the validation page used by staff or dashboard holders to manage data. The login page (https://five.epicollect.net/) is shown in Figure 6.

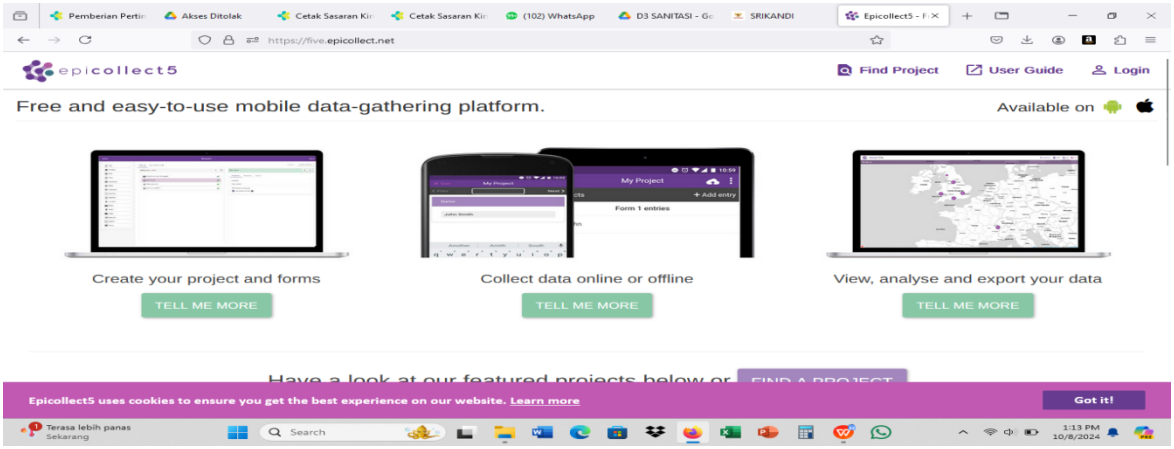

Figure 6. Login Page

Admin Home Page The admin home page is the first page displayed after the admin logs in. The admin home page is shown in Figure 7.

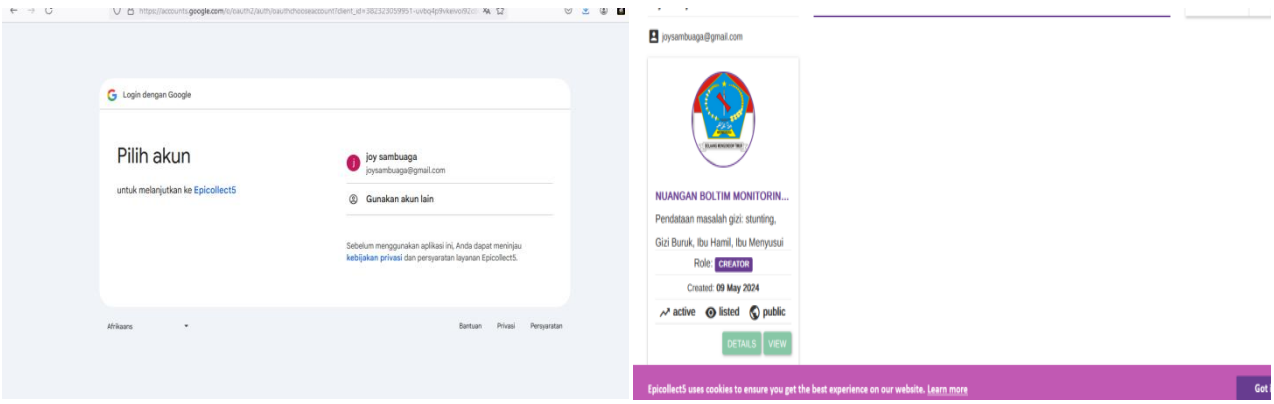

Figure 7: Admin Home Page

The Data View page is the page used by the admin to manage the collected data. The data view page is shown in Figure 8.

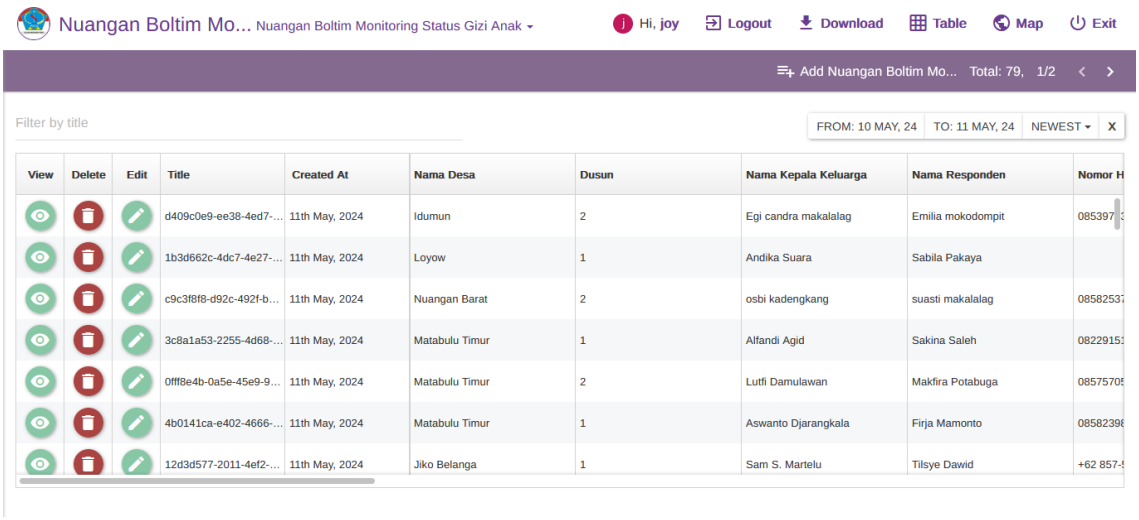

Figure 8. View Data Page

Regional Data Page

The add regional data page is the page used by the admin to view regional data in the form of a file containing the boundary coordinates used by polygon markers to mark regional boundaries. The regional data page is shown in Figure 9.

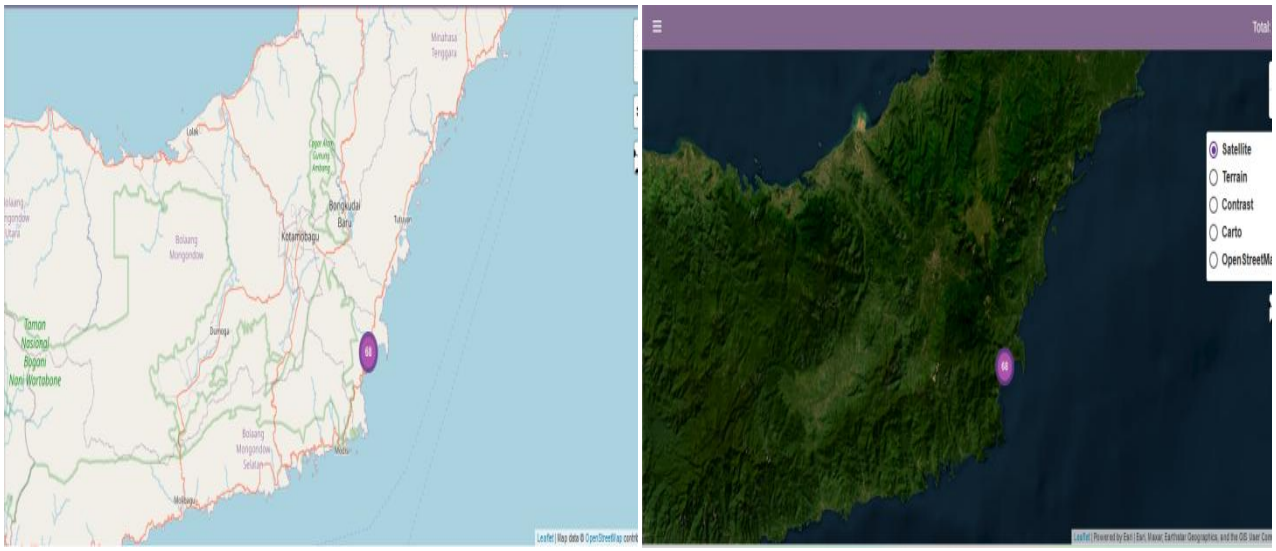

Figure 9. Regional Data Page

Stunting Risk Data Page

The Stunting Risk Data page is the page used to display Stunting Risk data. The Stunting Risk Data page is shown in Figure 10.

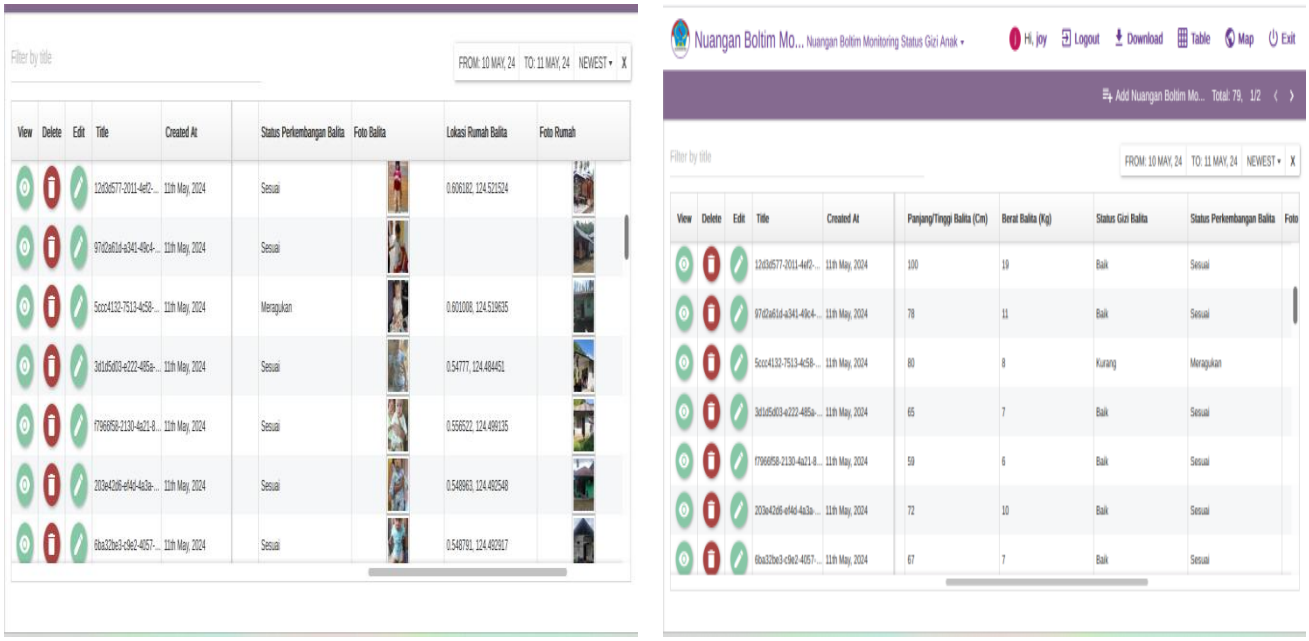

Figure 10. Stunting Risk data page

Officer Display Page

The officer display page is the page used to display officer data. The officer data display page is shown in Figure 11.

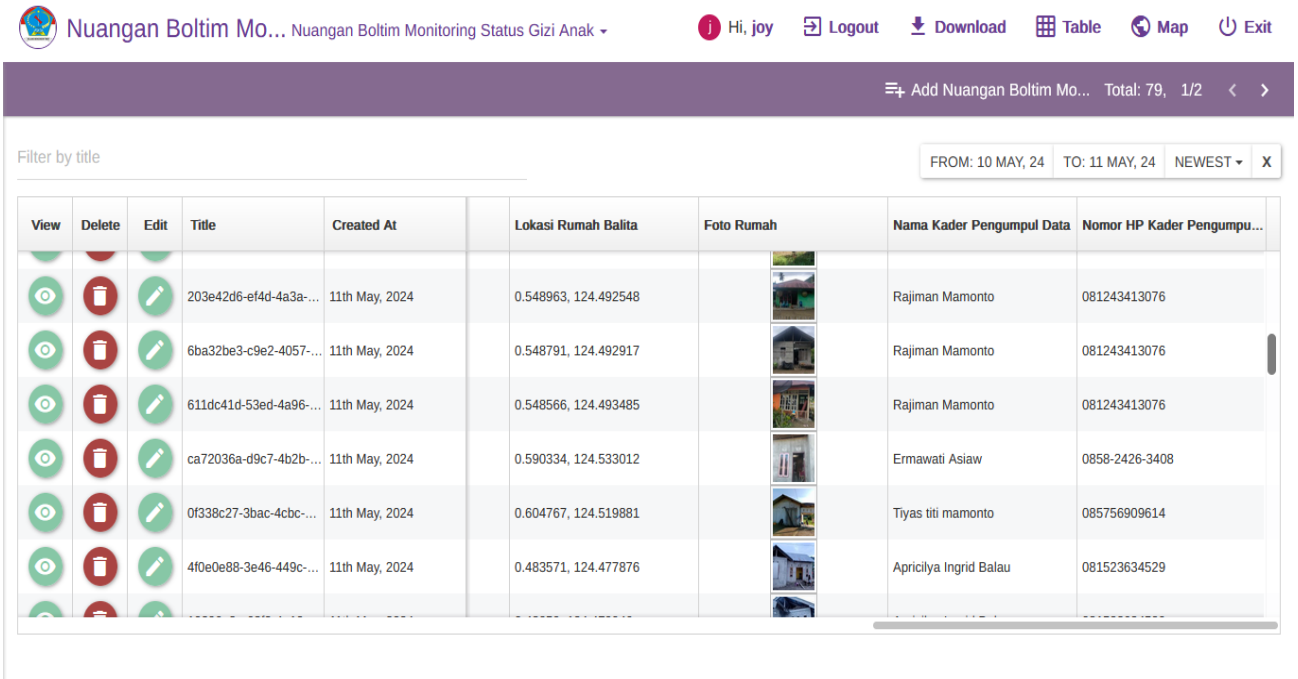

Figure 11. Officer Display Page

Add Officer Page

The add officer page is the page used by the admin to add officers to the information system. The add officer data page is shown in Figure 12.

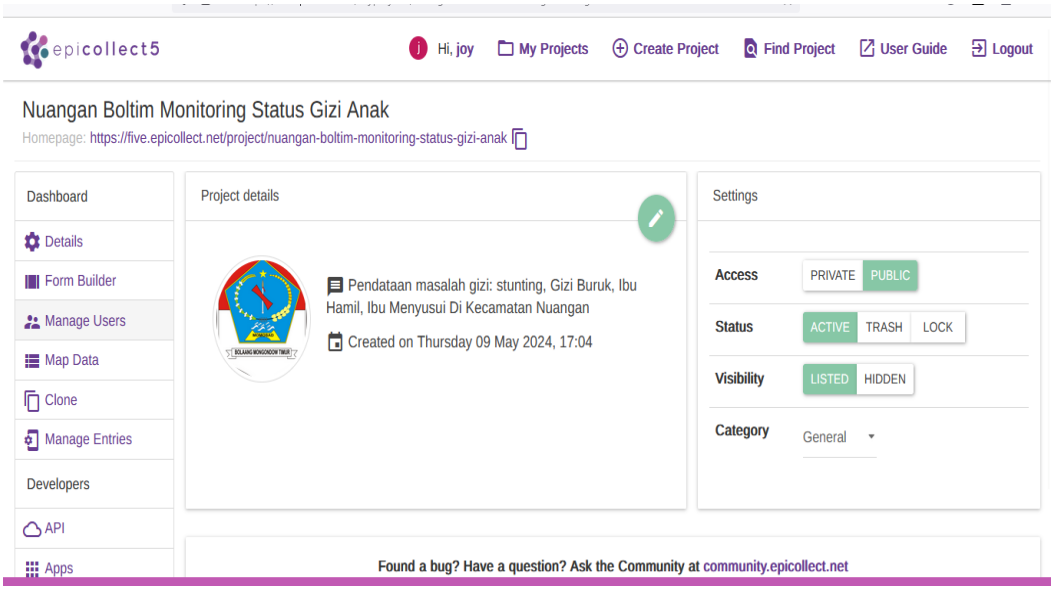

Figure 12. Add Officer Page

Officer Profile Edit Page

The officer profile edit page is the page officers use to edit their profiles, including editing their profile and editing their account password. The profile edit page is shown in Figure 13.

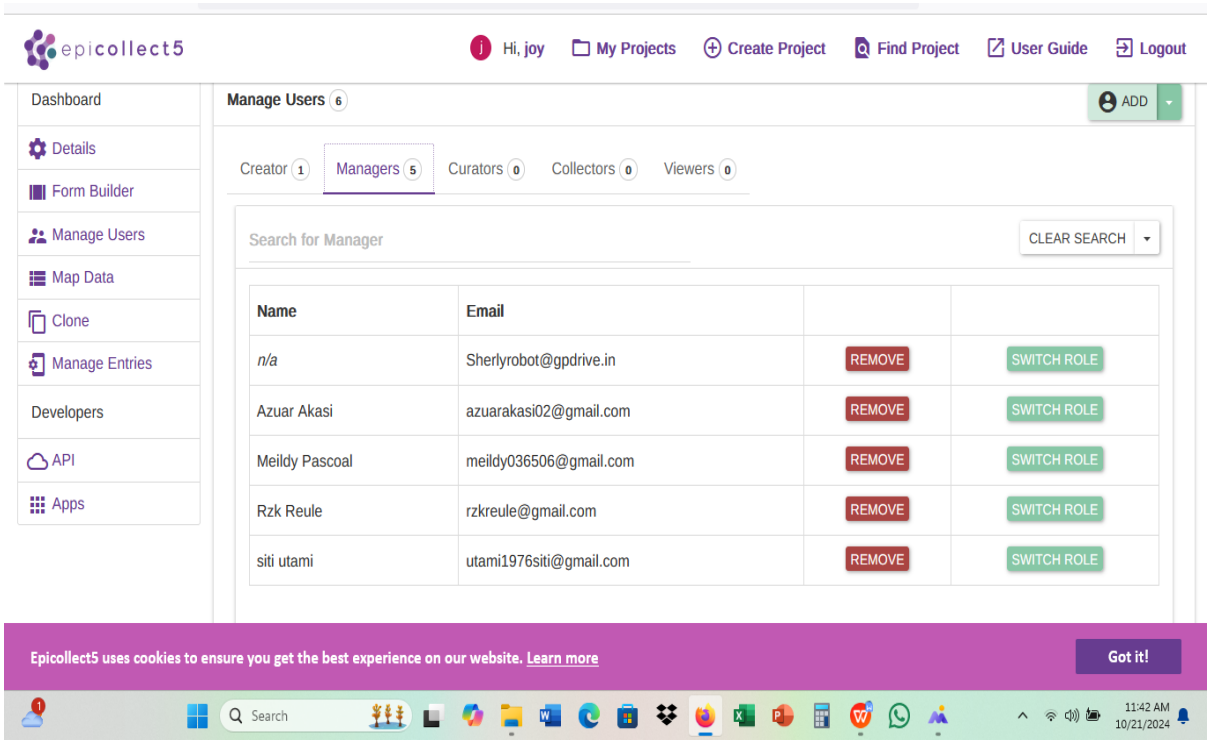

Figure 13. Officer Profile Edit Page

Stunting Data Map Display and Stunting Risk

On this page is a display of the downloaded report according to the date range entered when downloading the data, which can be seen in Figure 14.

Distribution Map of Toddlers, data collected by officers in Nuangan District

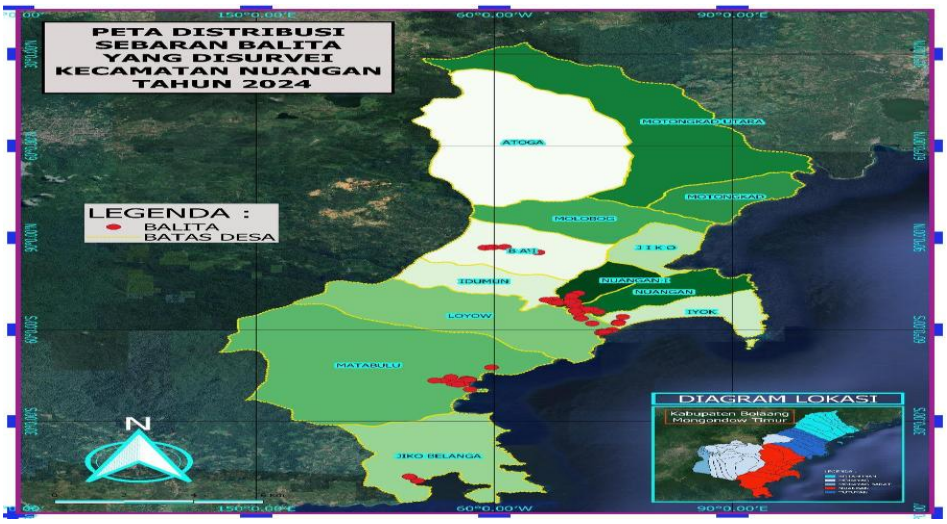

Figure 14. Toddler Distribution Map

Distribution Map of Toddlers Based on Body Weight Based on Data Collection Results by Officers in Nuangan District

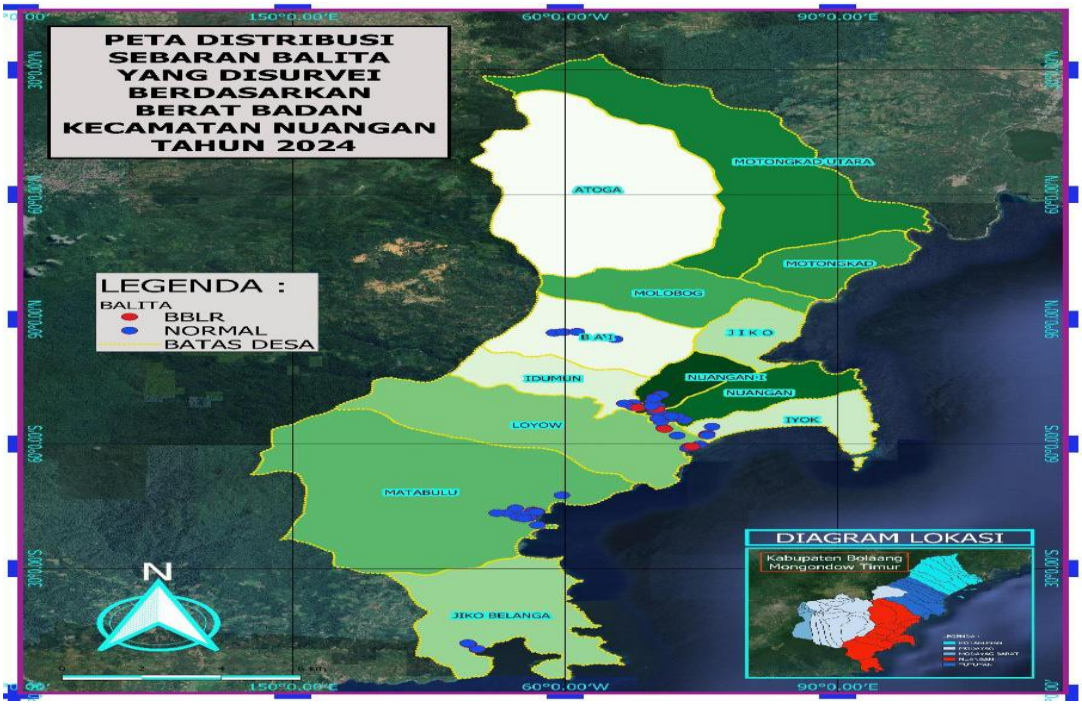

Figure 15. Map of Toddler Distribution Based on Body Weight

Distribution Map of Toddlers Based on Nutritional Status and Stunting Risk in Nuangan District

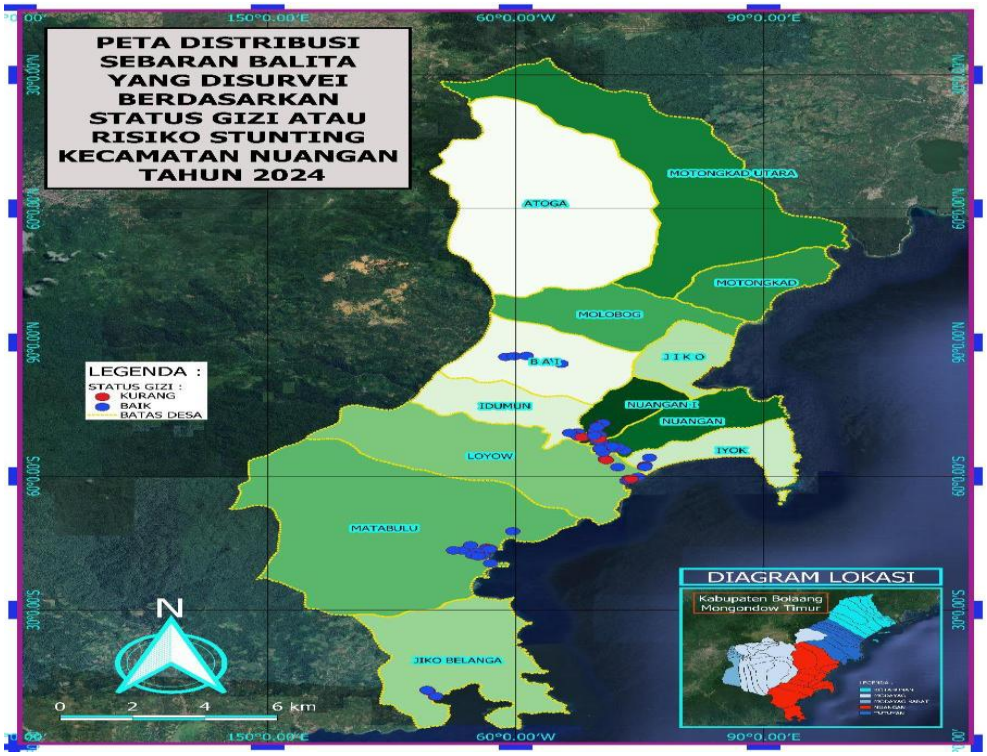

Figure 16. Distribution Map of Toddlers Based on Nutritional Status

DISCUSSIONS

Integrated Health Post (Posyandu), community health center (Puskesmas), sub-district, and other stakeholders can easily identify stunting locations through a Geographic Information System (GIS) to map and track the distribution of stunted children in the Nuangan Community Health Center (Puskesmas), Nuangan District, East Bolaang Mongondow Regency. This is because the application is equipped with several features, such as regional maps, stunting patient graphs, regional data reports, and others. Coordinates based on locations affected by stunting are listed on the regional map, facilitating precise and accurate positioning. This approach can quickly improve stunting areas. This supports the findings of Berutu et al. (2025), who stated that this mapping facilitates decision-making for more focused interventions in addition to providing a visual depiction of stunting distribution.(Berutu et al., 2025).

In various life contexts, including academic, professional, and everyday life, an individual's ability to master technology and information from digital devices can contribute to effectiveness and efficiency in any job.(Naufal, 2021)Employees with strong digital literacy skills should be able to find and select information, think critically and creatively, work and collaborate with others, and communicate clearly while taking into account the evolving sociocultural context and electronic security.(Adnjani et al., 2021) ; (Dunn & Hazzard, 2019).

An information system is a combination of various information technology components that work together and produce information in order to obtain a communication channel in an organization or group.(Fadhilah et al., 2025). The same thing is emphasized by Yanto et al (2024) that an information system is a collection of subsystems that are interconnected and integrated with each other and is a combination of

various information technology components that work together to manage data so that the processed data can be used as meaningful information and can help achieve organizational goals.(Yanto et al., 2024).

In terms of mapping and sharing information about stunting, Geographic Information Systems (GIS) are systems designed to handle data related to geographic coordinates with spatial references.(Saputra et al., 2018)To implement socialization, treatment, and evaluation of stunting, community health centers and health authorities can prioritize stunting cases and their distribution with the help of geographic information systems.(Siregar et al., 2023). Based on previous studies, the use of website-based GIS to address stunting in border areas can be an example for other areas facing similar public health problems in efforts to improve public health standards.(Siregar et al., 2023).

Geographic information systems allow for the creation of complex maps to depict the frequency of stunting in different regions of the study.(Yanto et al., 2024)High-risk locations can be identified using geospatial data, enabling more precise interventions. Furthermore, various datasets, including environmental, health, and demographic data, can be combined to analyze the causes of stunting. At the local level, this helps understand trends and causes of stunting. Stakeholders can monitor toddler health and the success of intervention programs using a GIS-based monitoring system. Visualizing data can help policymakers design more targeted measures to address stunting.

A web-based Geographic Information System (GIS) was developed as a result of this study to facilitate geographic monitoring of stunting cases by the Nuangan Health Center. Using geographic coordinates and attribute data such as name, age, and nutritional status, the system allows users to view the location of stunted toddlers. Features for managing child data, categorizing nutritional status, multi-user authentication based on roles (admin and staff), generating filtered reports, and exporting reports in Excel and PDF formats are also included in this system. This is also in line with Atmoko et al., (2025), who stated that data can be mapped or visualized based on the distribution of stunting from the city to the village level using a Geographic Information System (GIS).(Atmoko et al., 2025)

CONCLUSION

Based on the results of research conducted in the Nuangan Community Health Center working area, Nuangan District, East Bolaang Mongondow Regency and the use of Epicollect5 to create a geographic information system to map the location of developmental delays in children in the workplace. The Nuangan Community Health Center area, that with the development of the system, the software can display location points and information about children with developmental delays need to store data on the location of developmental delays. Children in the form of archives, but in digital form. The mapping and data collection process can be done more efficiently so it does not take a long time. This system will make it easier for the public to see areas affected by developmental delays and all information about developmental delays in children in the Nuangan Community Health Center working area.

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