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Development of Web-Based ANTROPO-NUTRISET for Stunting Screening and Monitoring at Posyandu

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ABSTRACT

Objective: *This study aimed to develop ANTROPO-NUTRISET, a web-based anthropometry and nutrition system supporting screening, monitoring, and initial decision support for stunting risk.* ***Method:*** *A design science approach with iterative prototyping was applied. The system was developed using PHP and MySQL, implemented weight-for-age and length/height-for-age Z-Score calculations based on WHO standards, and was demonstrated as a proof-of-concept using 10 synthetic child records. Evaluation focused on functional completeness, data-flow consistency, and readability of dashboard outputs.* ***Results:*** *ANTROPO-NUTRISET provides modules for child records, measurements, monitoring and decision support, dietary intake, geospatial mapping, reports, users, and sensor integration settings. In the simulated dataset, the dashboard displayed 10 children and 10 current-month measurements; five records were flagged for priority monitoring and five were categorized as normal. The screening detail page consolidated Z-Scores, nutritional categories, growth trends, recommended follow-up, and intervention history.* ***Novelty:*** *The novelty of this development lies in integrating a sensor-ready data workflow with monitoring and follow-up functions in a web architecture that can be deployed on standard hosting.*

INTRODUCTION

Stunting is a manifestation of impaired linear growth assessed through length or height for age. It reflects accumulated exposure to factors such as inadequate nutrition, recurrent infections, and limitations in caregiving environments and health services. Indonesia's 2024 Nutritional Status Survey reported a national stunting prevalence of 19.8% [1]. Early undernutrition may have lasting implications for cognitive development, educational attainment, productivity, and health [2]. Indonesian population data also show that stunting in young children is associated with multiple household and child-level factors [3].

Integrated community health posts (Posyandu) provide a setting for weighing, measuring length or height, offering nutrition education, delivering immunizations, and arranging referrals. Interpretation depends on accurate measurement, reliable child identification, correct age, the growth reference used, and consistent recording. The WHO Child Growth Standards provide a reference for children from birth to five years [4]. The WHO Multicentre Growth Reference Study describes the design underlying these standards [5]. Indonesian child anthropometry standards define national nutritional status categories [6]. Repeated transcription into registers, summary sheets, and separate applications can delay reporting and make individual growth trends difficult to trace.

From a health data and information management perspective, anthropometry records should link age, sex, measurement method, calculated Z-scores, nutritional categories, recommended actions, and intervention history. A longitudinal structure helps distinguish individual trends from one-time observations and supports facility-level reporting. Growth monitoring and promotion evidence highlights the importance of linking measurements to appropriate action [7].

Previous work in Indonesia includes a three-year hybrid action study on mobile Posyandu monitoring [8] and an online system for monitoring the continuity of maternal, child, and nutrition services [9]. The Stunting Super App examined the integration of education and management features [10], while work in West Java assessed WhatsApp for community nutrition surveillance [11]. In India, a national-scale nutrition program evaluated digital job aids and decision support for community nutrition workers [12].

Operational gaps include the need for browser-based access, integration across measurement and follow-up records, and clearly labeled priorities that cadres can interpret. Sensor integration also requires a way to verify measurements before linking them to an individual child. ANTROPO-NUTRISET addresses these gaps in a single web application for child records, anthropometry, WHO Z-scores, monitoring, dietary intake, follow-up, reporting, and mapping. This study developed the prototype and examined its functional feasibility using synthetic records. Posyandu Harapan Sejahtera provided the intended implementation context.

RESEARCH METHOD

Study design and requirements

The study used design science research, with a technology artifact as the primary output [13]. Development proceeded through problem identification, requirements, architecture and database design, iterative prototyping, demonstration, preliminary functional evaluation, and refinement. Requirements drew on the ANTROPO-NUTRISET concept, the earlier mobile APMONTING workflow, anthropometry standards, and health information management needs. Intended users included administrators, Posyandu personnel or cadres, and program managers.

Architecture and functions

The application uses PHP on the server, MySQL for relational data, HTML, CSS, and JavaScript in the browser, and a chart library for trends. Its logical architecture comprises presentation, application logic, the database, and a sensor integration interface. It can run on standard cPanel hosting and is accessed through a browser. Measurement records link to the child, date, method, staff member, and data source for traceability.

Functions include user and role management, child registration, measurements, nutritional classification, monitoring and decision support, dietary intake, intervention history, maps, reports, and sensor integration. The interface has consistent navigation, summary cards, tables, trend charts, and color indicators paired with text labels.

Table 1. Main components and outputs of ANTROPO-NUTRISET

Component	Input	Main output
Child records	ID, name, date of birth, sex, parents, address, coordinates	Longitudinal profile and unique identifier
Measurements	Date, weight, length or height, position, data source	Age, WAZ, HAZ, and nutritional category
Monitoring and DSS	Latest measurements and history	Priority, recommendations, and follow-up schedule
Dietary intake	Foods, portions, energy, and nutrients	Adequacy summary and counseling notes
Geographic distribution	Coordinates and latest status	Distribution and priority areas
Reports	Date, area, and status filters	Summary tables, printing, and export
Sensor integration	Device code, weight, height, signal, and timestamp	Device reading queue for verification

Anthropometric processing and decision support

The prototype calculates completed months of age from the date of birth and measurement date. It uses recumbent length below 24 months and standing height from 24 months onward. It applies the WHO growth reference parameters L, M, and S by sex, age, and index [4]. For $L \neq 0$, the LMS expression used by the prototype is $Z = ((X/M)^{L} - 1)/(L \times S)$. For $L = 0$, it is $Z = \ln(X/M)/S$. The main indices are weight-for-age (WAZ) and length/height-for-age (HAZ). Nutritional categories follow the national anthropometry standard [6]. Full agreement with WHO Anthro was beyond the scope of this demonstration.

The decision support system (DSS) applies prototype priority rules to both indices. It flags a record as very high priority where HAZ or WAZ is below −3 and as high priority where either is at least −3 and below −2. Values near the lower boundary may be marked for monitoring. Priority rules can therefore flag underweight when HAZ is normal. The resulting flags organize the review queue. Clinical validation of these rules and their recommendations remains pending.

Demonstration, ethics, and data security

The demonstration used 10 synthetic child identities and measurement histories with varied ages, sexes, and anthropometric categories. Evaluation consisted of a walkthrough from registration to results, checks of display consistency, and verification that status outputs could be stored and shown on the dashboard and individual pages. It did not assess clinical effectiveness, sensor accuracy, service time, or usability with cadres. No actual child records, patient records, or human participants were used.

The prototype includes authentication, role restrictions, password hashing, input validation, and staff records. Operational deployment would require appropriate

approvals and data governance for access, retention, backups, encrypted connections, audit logs, and incident handling.

RESULTS AND DISCUSSION

Results

The responsive web prototype includes a dashboard, child records, measurements, monitoring and DSS, dietary intake, geographic distribution, reports, users, and settings. The dashboard presents child and measurement totals, screening priorities, and nutritional categories. It displays measurement activity and individual-level records.

On the demonstration date of July 19, 2026, the dashboard showed 10 synthetic child records and 10 current-month measurements. Five records received a priority flag and five displayed a normal status. The latest-measurements list shows the measurement date and age, weight and length or height, WAZ, HAZ, and a link to the screening details. Table 2 summarizes observed prototype behavior.

Table 2. Preliminary functional checks using synthetic data

Function checked	Observed output	Status
Child registration	Identity saved and displayed in the list	Functional
Measurement recording	Weight, length or height, age, and method saved	Functional
Z-score calculation	WAZ and HAZ displayed	Functional
Status classification	Nutritional category and risk priority displayed	Functional
Dashboard	Summary cards, charts, and recent records displayed	Functional
Screening details	Recommendations, individual charts, and interventions displayed	Functional
Reporting	Records could be filtered and prepared for printing or export	Functional
Sensor data	Device data could be received in the queue	Prototype function

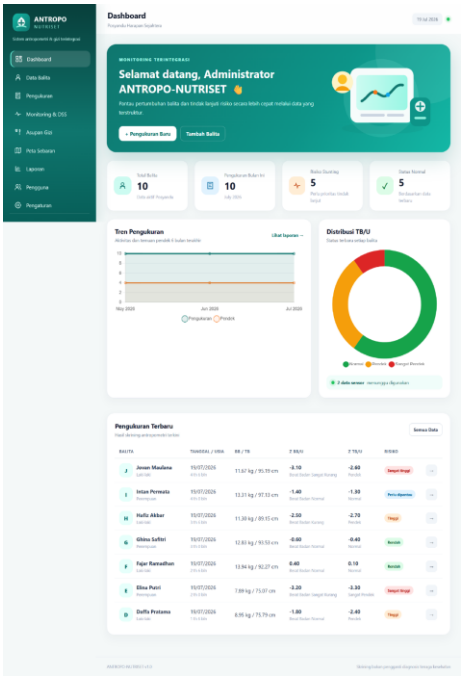

Figure 1. Web-based ANTROPO-NUTRISET monitoring dashboard

The screening detail page combines the priority level, Z-scores, body mass index, recommendations, growth trends, follow-up form, and past interventions. One synthetic record displayed a weight of 6.80 kg (WAZ −2.30) and a length of 69.64 cm (HAZ −1.70). The system displayed underweight and normal length-for-age, with high monitoring priority under the prototype rules. The detail page illustrates how the interface presents the two anthropometric indices alongside follow-up options.

Users can select an intervention, save notes, and schedule a return visit. The system displays past interventions chronologically and plots repeated WAZ and HAZ measurements. The database supports multiple measurements, intake records, and interventions per child. A sensor queue holds device readings for verification before they are associated with a child's record.

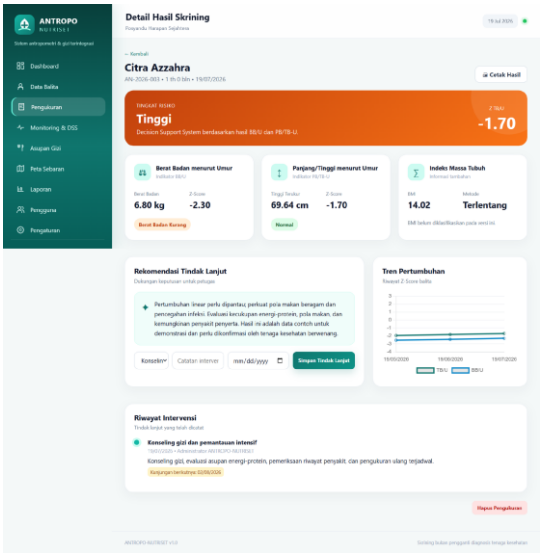

Figure 2. Screening details, recommendations, growth trends, and intervention history

Discussion

The prototype brings identification, measurement, interpretation, follow-up, and reporting into one longitudinal workflow. Structured source fields help users trace how errors in birth date, measurement position, or reference selection could affect calculated categories. The dashboard provides a population summary alongside links to individual records. For cadres, this can support planning follow-up while retaining access to the measurements behind each flag.

The web interface builds on Posyandu monitoring work that linked local data with broader information needs [8]. Central updates and browser access can simplify distribution across devices, although connectivity and hosting reliability need evaluation. Online monitoring has also been used to assess continuity of maternal and child services [9]. At Posyandu level, linked records could help cadres review previous recommendations and planned visits.

Priority flags are intended for screening and follow-up. Anthropometry should be interpreted in context, including measurement quality, diet, health history, and household factors. Research in Bali found associations involving sociodemographic and healthcare factors [14]. The outputs on the individual page connect a flag to a record, a follow-up form, and intervention history. The synthetic distribution does not estimate the prevalence of stunting.

The platform complements digital approaches that emphasize content and acceptance [10] or familiar communication channels [11]. A messaging channel might support reminders in later development. Sensor integration may reduce transcription, but calibration, repeatability, measurement position, units, and the identity linked to each reading require verification. The queue is designed to support review before saving, and the demonstration did not establish measurement accuracy.

Cadres remain central to measuring children, explaining findings, and arranging follow-up. Studies have examined cadre training and its contribution to knowledge [15] and factors that affect knowledge and motivation [16]. The system should make the basis of each flag clear and avoid relying on color alone. Digital job aids are sensitive to supervision and workflow [12], and Indonesian implementation research identifies coordination and resource allocation as important to stunting programs [17].

Potential information management benefits include deduplication, detection of implausible values or duplicate measurements, period-based reporting, and geographic planning using appropriately aggregated data. Routine deployment also requires controls on location precision, export access, correction and deletion, backups, and incident response. Practical evaluation should include task completion time, errors, interviews, and perceived usability measures such as the System Usability Scale [18].

The prototype combined a sensor verification queue, Z-scores, screening prioritization, dashboard summaries, individual trends, intake, mapping, and intervention history. All records were synthetic, the indicators were not validated against clinical assessments, calibration was not tested, and there was no formal user evaluation. Load, intermittent connectivity, security, and external integration also remain untested.

Future work can compare manual and digital recording, verify agreement with WHO Anthro and standard equipment, and measure completeness, service time, and follow-up.

CONCLUSION

Fundamental Finding: Web-based ANTROPO-NUTRISET was developed as an integrated prototype to support stunting screening and monitoring at Posyandu. The demonstration using 10 synthetic records showed that measurement results could be processed and presented consistently at population and individual levels. **Implication:** The prototype has the potential to strengthen health data and information management by reducing fragmented recordkeeping and making follow-up easier to trace. **Limitation:** All data were synthetic, so the status distribution on the dashboard does not represent prevalence at Posyandu Harapan Sejahtera. The DSS algorithm uses simple rules and has yet to be validated by a clinical panel. **Future Research:** Sensor calibration, algorithm validation, usability testing, security evaluation, and research using real-world data with ethics approval are required before operational implementation.

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