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Development of Malnutrition Profiling and Monitoring System

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Abstract **- This project developed an integrated mobile, and web, application to improve data collection and reporting on malnourished children by Barangay Nutrition Scholars. The system was built using the Waterfall model, which included requirements analysis, system design, development, testing and evaluation, and deployment. Development technologies included Laravel, Flutter, HTML, CSS, JavaScript, Bootstrap, MySQL, and SQLite. The system allowed BNS to record, update, and monitor children's nutrition data through mobile and web platforms. Key features included child profiling, automatic nutrition status computation, report generation, and secure login access. The system was tested with BNS users to evaluate its performance against manual processes. Results showed that users completed data entry tasks faster, produced accurate records, experienced fewer errors, and generated reports more efficiently than manual methods. The system replaced paper-based monitoring with digital tools that enabled real-time data access and synchronization across devices. This reduced administrative work and improved data accuracy for nutrition monitoring. The findings showed the system effectively supported BNS operations and improved malnutrition monitoring. The digital solution addressed gaps in traditional monitoring and provided a practical tool for tracking children's nutritional status in barangay communities. The system improved workflow efficiency and data management for health workers.**

Keywords**—Profiling, Offline functionality, Waterfall model, Mobile application, Web-based System, Malnutrition.**

1. INTRODUCTION

Information Technology (IT) has been widely applied in various sectors to improve the
performance and efficiency of organizational operations. In the health sector, information technology is used to record and monitor public health programs in the fight against malnutrition. Malnutrition is a serious health problem, especially in children aged 0–59 months and pregnant women, because it interferes with growth and development.

In the Philippines, malnutrition monitoring at the community level is primarily conducted by Barangay Nutrition Scholars (BNS). In Sta.Cruz, Tagoloan, Misamis Oriental, the BNS conducts house-to-house surveys to gather data on the nutritional status of children and infants. They measure and analyze BMI (Body Mass Index), height-for-age, weight-for-height and weight-for-age. Monthly and yearly reports are submitted to Barangay Health Workers (BHW), Rural Health Unit (RHU) and the provincial government. However, the data is still collected using simple paper-based checklists and manually entered into spreadsheets.

Manual data collection and encoding are time-consuming, prone to human error and limited in quantity. Some of the common mistakes include inaccurate entries, missing data files, duplications and accidental deletion of files. Studies show that manual data entry errors range from 0.5% and 4%. 05% to 9%, which can affect data quality and decision-making (Wills, A. K., 2020). In Sta.Cruz The current manual system can only handle about 1,000 children's records, but the number of monitored children is on the rise.

In order to meet the current demand for timely and high-quality health information, it is imperative to implement digital solutions (web-based and mobile applications) in data management processes. Studies have established that electronic data collection systems lower error rates, improve workflow efficiency and strengthen the collected data's reliability. There is a need to develop a digital malnutrition profiling and monitoring tool to support BNS in their work.

II. PROBLEM STATEMENT

The current malnutrition monitoring process in Sta.Cruz, Tagoloan, is based on the manual collecting of data on paper, which is then entered into spreadsheets. This procedure takes a long time and is prone to human error, including incomplete records, duplicate entries, and unintentional data deletion. Additionally, the existing method's low data capacity makes it challenging to handle the increasing number of nutrition records and sustain data consistency and accuracy over time.

Effective monitoring and response to malnutrition is complicated by the continuous use of outdated manual techniques while the need for precise, fast, and efficient health data increases. To increase data accuracy, workflow efficiency, and quick action in malnutrition cases, a centralized, web-based, and mobile malnutrition profiling and monitoring system that facilitates digital data collection, automated nutritional assessment, real-time visualization, and integrated reporting is desperately needed.

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III. OBJECTIVES OF THE STUDY

The primary objective of this study is to design and develop a web-based and mobile Malnutrition Profiling and Monitoring System to improve the efficiency, accuracy, and reliability of malnutrition data collection for children aged 0–59 months and pregnant women in Sta.Cruz, Tagoloan, Misamis Oriental.

A. *Specific Objectives*

Specifically, the study aims to:

1. Develop a digital platform that allows Barangay Nutrition Scholars to collect, store, and manage nutritional data electronically.
2. Integrate standardized growth charts and automated nutritional assessment calculations.
3. Generate comprehensive monthly, yearly, and summary reports on malnutrition status and feeding attendance.
4. Enable continuous monitoring of malnutrition cases to support timely health interventions.
5. Design an intuitive, user-friendly web and mobile interface for users with limited technical skills.
6. Evaluate the system's impact on data accuracy, reliability, and overall improvement of malnutrition monitoring practices.

IV. REVIEW OF RELATED WORK

Recent studies show that web-based and mobile information systems significantly improve data accuracy, efficiency, and accessibility compared to manual and paper-based processes. In health and monitoring applications, digital platforms support data collection, profiling, reporting, and decision-making. Systems developed with structured and agile methodologies show that automating data entry and monitoring reduces human error and improves workflow efficiency, especially in environments with large volumes of records.

Previous studies used development models such as Waterfall, Iterative, Agile, and SCRUM, often with PHP and MySQL for backend development and mobile technologies for wider accessibility. Systems like the Timbang App and other monitoring platforms reported acceptable functionality and accuracy, but usability issues, limited reporting, and lack of real-time access remained. Other studies noted that while digital systems improved monitoring and record management, challenges like slow data synchronization, no offline features, and limited integration between web and mobile platforms affected effectiveness.

Health-related studies on child growth, nutrition monitoring, and maternal health emphasized the importance of real-time data access, usability, and reliable database management. Mobile and web-based applications effectively supported health workers by enabling faster data collection, better tracking of nutritional status, and improved reporting. However, several systems lacked offline functionality, comprehensive profiling, or seamless mobile and web integration, which limited their use in remote or low-connectivity areas.

Overall, the reviewed literature indicates a need for an integrated, user-friendly malnutrition monitoring system that combines web and mobile platforms, supports offline and online data collection, ensures accurate nutritional assessment, and generates comprehensive reports. These gaps informed the development of the proposed Malnutrition Profiling and Monitoring System, which aims to enhance usability, data accuracy, and accessibility for Barangay Nutrition Scholars.

V. METHODOLOGY

The study used the traditional Waterfall software development model, which follows a linear process of requirements analysis, system design, implementation, testing, evaluation, and deployment. This approach was chosen because system requirements were clearly defined through structured interviews and workflow analysis with Barangay Nutrition Scholars (BNS) in Sta.Cruz, Tagoloan. In the design phase, system functionality and data flow were modeled using use-case diagrams, data flow diagrams, and entity-relationship diagrams to define processes, user interactions, and database structure. User interface layouts were designed to ensure usability, consistency, and accessibility for non-technical users, supporting efficient data entry and navigation.

The system was implemented using Laravel as the backend framework to manage business logic, authentication, and report generation. Flutter was used to develop the mobile application for cross-platform deployment. The web interface was built with HTML, CSS, JavaScript, and Bootstrap to ensure responsiveness. MySQL served as the primary database for centralized data storage, while SQLite was integrated into the mobile application for offline storage and synchronization. A RESTful API enabled secure data exchange between web and mobile platforms. Development and local testing were done using Visual Studio Code and XAMPP to ensure system stability and functionality before deployment.

VI. RESULTS AND DISCUSSION

This section presents the evaluation, comparison, and analysis of the Malnutrition Profiling and Monitoring System. The results focus on performance, usability, accuracy, and efficiency compared with the manual process used by Barangay Nutrition Scholars (BNS). Evidence from system outputs, usability results, and performance comparisons demonstrates the effectiveness of the developed web-based and mobile application.

A. *System Performance Evaluation*

The developed system showed stable performance during testing and user evaluation. The web and mobile

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applications handled child and pregnant-women records without data loss or system crashes. Automated calculations for nutritional status gave accurate results using standard growth charts, reducing manual errors. Report generation was much faster than the manual method, letting BNS create monthly, yearly, and summary reports in seconds.

Fig. 1. Nutrition Status Page

Figure 1 presents the Nutrition Status Page displays recorded nutritional data of children, including key indicators to assess their health. It offers a clear, organized view to support accurate monitoring and evaluation by Barangay Nutrition Scholars.

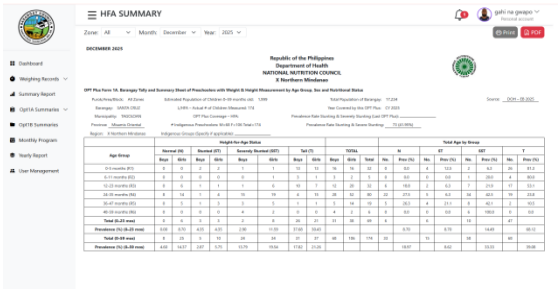

Fig. 2. Report Generation Page

Figure 2 presents the Weight-for-Age Summary Report Page shows the distribution of children by weight-for-age classifications. It helps Barangay Nutrition Scholars quickly identify underweight, normal, and overweight cases for monitoring and intervention.

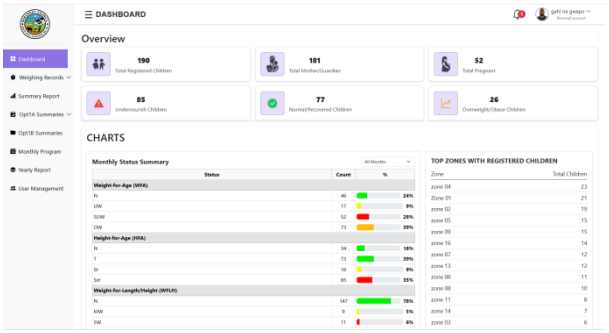

Fig. 3. Dashboard Page

Figure 3 presents the Dashboard Page provides an overview of key nutrition indicators and system statistics. It allows Barangay Nutrition Scholars to monitor trends and identify priority cases at a glance.

B. *Usability Results And Analysis*

Usability was evaluated using the System Usability Scale (SUS). Results showed users found the system easy to use, well-organized, and efficient for tasks like data entry, updating records, and generating reports. The interface supported users with limited technical skills, leading to higher satisfaction and reduced training time.

	System Usability Scale (SUS) Questionnaire						
	Questions	*P1*	*P2*	*P3*	*P4*	*P5*	*Total*
1.	I think that I would like to use this mobile app more often.	4	4	3	4	4	
2.	I found the mobile app difficult to use.	3	3	1	2	3	
3.	I think this mobile app is easy to use.	4	4	3	4	4	
4.	I think that I would need assistance to be able to use this mobile app.	1	1	1	1	3	
5.	I found the various functions in this mobile were working well together.	4	4	3	4	4	
6.	I thought there was too much confusion in this mobile app.	3	1	0	0	4	
7.	I would imagine that most people would learn to use this mobile app very quickly.	3	4	2	4	4	
8.	I think the system is better than the manual process.	0	0	1	1	0	
9.	I feel very confident using this mobile app.	4	4	3	4	3	
10.	I had difficulty understanding some features of the mobile app.	3	0	1	3	3	
	Total	72.5	62.5	45	67.5	80	327.5
	Average SUS Score: 65.5						

TABLE I. System Usability Scale (SUS) Result

Table 1 presents the final System Usability Scale (SUS) score for the system. The SUS score of 65.5, categorized as Good, shows the system is generally easy to use and meets users' basic usability expectations, though further improvements could help achieve an excellent rating.

C. *System-Based Functional Comparison*

This section compares the existing manual process and the developed malnutrition profiling and monitoring system, focusing on differences in data handling, system capabilities, and workflow efficiency.

TABLE II. Feature Comparison of Manual and Developed System

	Feature Comparison of Manual and Developed System		
	Aspect	*Manual Process*	*Developed System*
1.	Data entry	Paper Forms and Excel	Direct digital entry
2.	Validation	None	Automatic Validation
3.	Duplicate checking	Manual	System-Controlled duplicate prevention
4.	Nutritional status	Chart reference	Automated classification
5.	Reporting	Manual prepared	Automatically generated reports
6.	Data storage	Limited by spreadsheets	Centralized data storage
7.	Offline support	Not supported	Supported through mobile application
8.	Attendance recording	Manual recording	Automated attendance tracking
9.	Nutrition case alerts	Not available	Supported through system indicators
10.	Scheduling	Manually managed	System-supported scheduling
11.	Certificate generation	Not available	System-supported certificate generation
12.	SMS notification	Manually communicated	System-supported SMS notification
13.	Individual child profiling	Not available	System-supported individual child profiling

Table 2 presents the functional differences between the manual process and the developed system. The manual approach relies on paper records and spreadsheet encoding with limited validation, monitoring, and automation, which can lead to errors and inefficiencies. The developed system supports digital data entry, automated validation, centralized data storage, and features such as nutritional status classification, attendance tracking, certificate generation, SMS notifications, and individual child profiling. These enhancements improve data consistency, reporting efficiency, and monitoring capability, especially in environments with limited internet connectivity.

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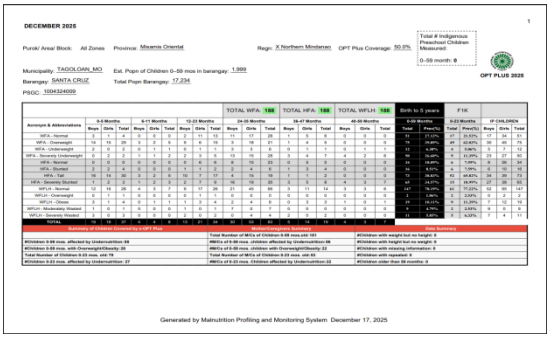

Fig. 4. Generated Summary Report

Figure 4 presents a comprehensive overview of nutritional data for children in a specified zone. It includes figures such as the total number of children, prevalence rates for nutritional statuses, and categories like underweight and stunting. Users can compare figures across age groups and genders, providing insights for health assessments. The report also features summary statistics that highlight key findings and trends.

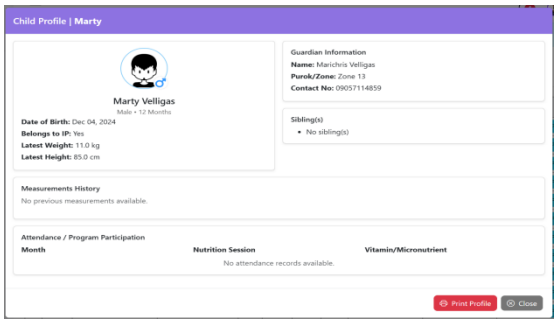

Fig. 5. Child Profiling

Figure 5 presents the Child Profiling page presents information for each child, including personal details and nutrition measurements. It enables Barangay Nutrition Scholars to monitor individual growth and nutritional status efficiently.

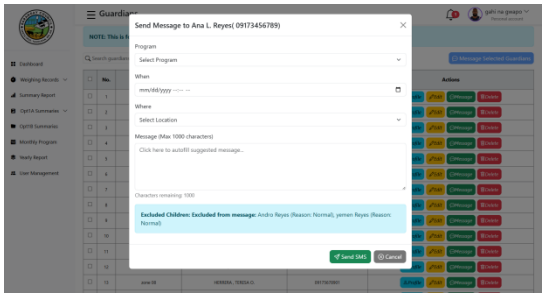

Fig. 6. Short Message Service (SMS)

Figure 6 presents the SMS Notification page lets the system send automated alerts and reminders about feeding and reweighing day. It helps Barangay Nutrition Scholars communicate important information to guardians efficiently.

VII. CONCLUSION AND FUTURE WORK

The Malnutrition Profiling and Monitoring System addressed the limitations of the manual paper-based process by providing a digital solution for profiling, monitoring, and reporting malnutrition data. The system improved data accuracy, organization, and reporting efficiency through automated nutritional assessment, growth chart integration, and centralized data management. Usability evaluation results showed the system was easy to use and supported faster data entry and monitoring, even for users with limited technical skills. Minor limitations with device performance and internet connectivity did not affect the accuracy or core functionality of the system.

Future work should focus on optimizing system performance on low-end devices, improving offline data synchronization, and simplifying system features to enhance usability. Additional modules such as vaccination and deworming tracking, growth trend analysis, and integration with barangay or municipal health information systems may further strengthen the system's functionality, scalability, and long-term applicability.

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