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Development of Traditional Snack Selection Simulation App Based on MDLC as Nutritional Literacy Media for Housewives

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Abstract: The increasing prevalence of Non-Communicable Diseases (NCDs) in Indonesia is closely linked to excessive consumption of Sugar, Salt, and Fat (GGL). Despite regulations, nutritional literacy among housewives remains low, particularly in interpreting complex labels on traditional snacks. This research develops "Sendok Sehat," an Android-based simulation application designed as a nutritional literacy medium using the Multimedia Development Life Cycle (MDLC) methodology. The application transforms technical GGL data into practical Household Units (URT), such as tablespoons, to simplify housewives' understanding. The system features a dummy marketplace interface with a real-time "Warning Page" that provides educational interventions if the shopping cart exceeds daily GGL limits. Functional validation through Black Box Testing on 8 core test scenarios confirmed a 100% success rate, specifically in the GGL filtering logic and automated literacy feedback. This research concludes that "Sendok Sehat" serves as an interactive tool to empower housewives in making healthier dietary choices, providing a practical bridge between health regulations and daily shopping habits.
Keywords: Multimedia Development Life Cycle; Nutritional Literacy; Android Application; GGL Filter; Traditional Snacks; Black Box Testing

1. INTRODUCTION

The era of digital transformation has significantly changed the landscape of business and commerce, including the food industry in Indonesia [1], [2]. This evolution enables individuals to interact and manage transactions more efficiently through digital platforms [3]. However, this culinary growth is accompanied by a rise in Non-Communicable Diseases (NCDs) such as hypertension, stroke, and diabetes, which are closely linked to excessive consumption of Sugar, Salt, and Fat (GGL) [4]. Despite the government's efforts through Ministry of Health Regulation No. 30 of 2013, the implementation of GGL information inclusion as a prevention strategy for NCDs still faces various challenges [5].

A major problem lies in the low level of nutritional literacy among the public, especially housewives who play a crucial role in household food security [6]. Many consumers lack the knowledge to read food labels properly or fail to comply with health warnings due to a lack of understanding [7]. Furthermore, there is a significant gap in translating nutritional values into practical daily measurements. Most housewives struggle to convert grams into Household Measures (URT), which are more intuitive for daily use [8]. This issue is further complicated by the fact that many traditional snacks often sold through consignment systems or local producers lack standardized nutritional information and digital visibility [2], [9].

Several studies have explored digital solutions for food and nutrition. Research by Jatika [1], and Legi [2], focused on digitalizing food ordering and agricultural marketing to empower local

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producers. Other developments include the use of YOLO-based image detection for food nutrition information [10], and the use of interactive multimedia to enhance the understanding of fundamental values [11]. The critical research gap addressed in this study is the absence of health-based filtering in existing food platforms, specifically the lack of simulation media that provides real-time GGL monitoring tailored to the shopping behavior of housewives [12], [13].

Our research addresses these gaps by developing a simulation application named "Sendok Sehat." This application is designed as a dummy marketplace that mimics the UI/UX of popular e-commerce platforms to ensure ease of use for housewives [13]. The development follows the Multimedia Development Life Cycle (MDLC) methodology, which encompasses stages from concept to distribution, ensuring a robust and educational experience for housewives [14], [15]. Unlike previous nutritional apps, "Sendok Sehat" integrates a real-time GGL filter based on the Permenkes 30/2013 standards and utilizes URT (spoon/pinch visualizations) to make nutritional data more accessible [8].

The key innovation of this research lies in its real-time GGL filtering mechanism, which serves as a preventive tool against excessive consumption of sugar, salt, and fat. Unlike conventional e-commerce, "Sendok Sehat" implements a critical intervention through a "Warning Page" that appears whenever the shopping cart exceeds the GGL limits established by Ministry of Health Regulation No. 30 of 2013. This page functions as the primary nutritional literacy medium, providing educational explanations regarding the health risks of excessive GGL such as hypertension and diabetes while encouraging housewives to substitute their choices with healthier options. By combining the principles of e-learning platforms [3], and interactive simulations [11], this application serves as a participatory public education tool to strengthen food security and nutritional literacy among housewives [6]. Ultimately, this study aims to provide a practical solution for monitoring family intake through a familiar and interactive digital environment that strictly adheres to national health standards.

2. RESEARCH METHODOLOGY

2.1 Research Stages

The research process is conducted through several systematic stages. First, problem identification is performed to analyze the gap between GGL regulations and the shopping habits of housewives. This is followed by a literature study to gather theoretical foundations from previous research. The data collection stage involves observing consignment stalls to build a product database. After the data is gathered, the system development begins using the MDLC method. Finally, the application undergoes functional testing to ensure all features operate according to the predefined nutritional safety logic.

2.2 System Development Method

The system development method used in this research is the Multimedia Development Life Cycle (MDLC). This methodology consists of six distinct stages: concept, design, material collecting, assembly, testing, and distribution. MDLC is specifically designed for the development of applications that integrate various multimedia elements such as text, images, and interactive logic.

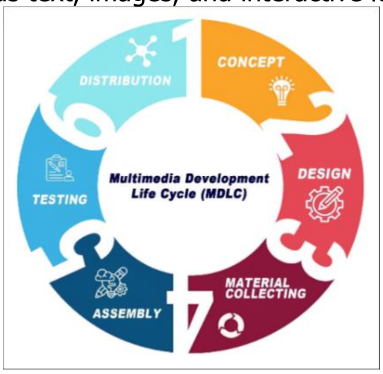

Figure 1. Stages of the Multimedia Development Life Cycle (MDLC) Methodology

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Figure 1 shows six stages defined as follows:

1. Concept: This initial stage involves determining the purpose of the application, identifying the target audience (housewives), and establishing the overall objectives or basic rules of the multimedia project.
2. Design: The design stage focuses on creating detailed specifications for the application's architecture, including storyboards, flowcharts, and user interface (UI) layouts to visualize the system's flow.
3. Material Collecting: This stage is the process of gathering all necessary assets for the project, such as images, graphics, audio, animations, and the database or raw data required for the application's content.
4. Assembly: The assembly stage is the actual production phase where all collected materials and design specifications are integrated into a functional application using programming languages and development tools.
5. Testing: This stage involves evaluating the application to ensure it functions according to the design specifications. It aims to identify any errors, bugs, or inconsistencies in the system's features and logic.
6. Distribution: The final stage involves packaging the application into a ready-to-use format and deploying it to the intended user or storing it on a distribution medium.

2.3 Research Data-Gathering Methods

Data collection was carried out using two primary techniques to ensure the application's accuracy and relevance:

1. Observation: Researchers directly visited local consignment stalls (*lapak konsinyasi*) to identify common traditional snacks. This process involved documenting product names, prices, and portion sizes to build a realistic database for the simulation.
2. Literature Study: This technique involved collecting and analyzing 15 relevant journals and official documents, including Permenkes No. 30 of 2013 and Household Measures (URT) standards. This study provided the necessary parameters for the GGL filtering logic and the nutritional literacy content.

2.4 Testing and Analysis Method

This study strictly employs Black Box Testing to validate the application's functional performance without inspecting the internal code. The primary objective is to verify that all user interface elements such as the search bar, cart, and the mood setting in the profile function as intended. Most importantly, the testing focuses on the GGL filtering logic. The system must accurately trigger the "Warning Page" with educational literacy content if the total GGL in the cart exceeds the safety limits. If the cart remains within the safety threshold, the system must navigate the user to the "Success Page".

3. RESULT AND DISCUSSIONS

The developed system is an Android-based nutritional literacy simulation application named "Sendok Sehat," built using the Kotlin programming language and Android Studio. This application integrates Google Sheets as a cloud-based database to manage product information and GGL (Sugar, Salt, Fat) nutritional data dynamically. Designed with an e-commerce-style interface to ensure ease of use for housewives, the system operates with a single-user access level that allows housewives to simulate snack selection, set health "Moods," and receive real-time nutritional filtering. The core logic of the application serves as a digital gatekeeper, validating every shopping cart entry against the health standards of Ministry of Health Regulation No. 30 of 2013 to prevent the risk of non-communicable diseases. Overall, the development process resulted in a fully functional prototype that successfully passed 8 core Black Box testing scenarios with a 100% success rate, ensuring accurate GGL calculation and real-time literacy feedback.

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3.1 Use Case

Based on the use case diagram in Figure 2, the Housewife as the primary actor can perform several activities within the "Sendok Sehat" application. Housewives can access the splash screen for database synchronization, browse the product list on the home page, search for specific traditional snacks, and manage their health profile through the "Mood Setting" feature. Additionally, the housewives can view detailed nutritional information in Household Measures (URT), manage the shopping cart, and receive nutritional literacy feedback through the warning or success pages. The system also allows housewives to save healthy shopping simulations to the notes and review their detailed history.

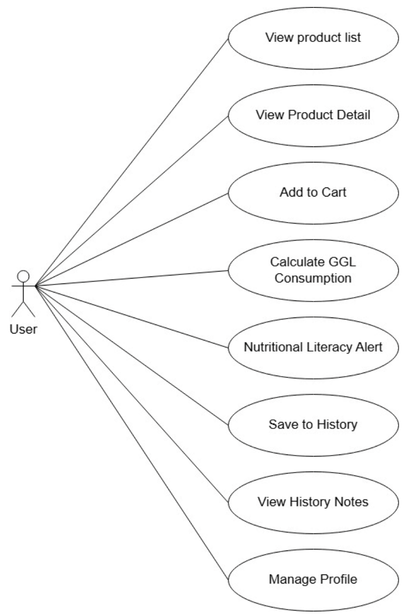

Figure 2. Use Case Diagram illustrating Housewife interactions within the Sendok Sehat system

In the system logic, the "Mood Setting" use case significantly influences the GGL filtering process in the shopping cart. When the housewife selects a specific health goal, such as "Prevent Diabetes" or "Prevent Hypertension," the system automatically adjusts the GGL limits for sugar, salt, and fat. All transaction data and nutritional calculations are synchronized with Google Sheets as the cloud database, ensuring that the literacy content delivered on the warning page remains accurate and up-to-date according to health standards.

3.2 Activity Diagram

The activity diagram in Figure 3 illustrates the dynamic flow of the "Sendok Sehat" application, highlighting the interaction between the housewife and the system logic. The process begins with the automated synchronization of product data from Google Sheets, followed by the housewife's selection of a health "Mood" which defines the GGL limits. As the housewife interacts with the product list and adds items to the cart, the system continuously prepares the data for nutritional validation.

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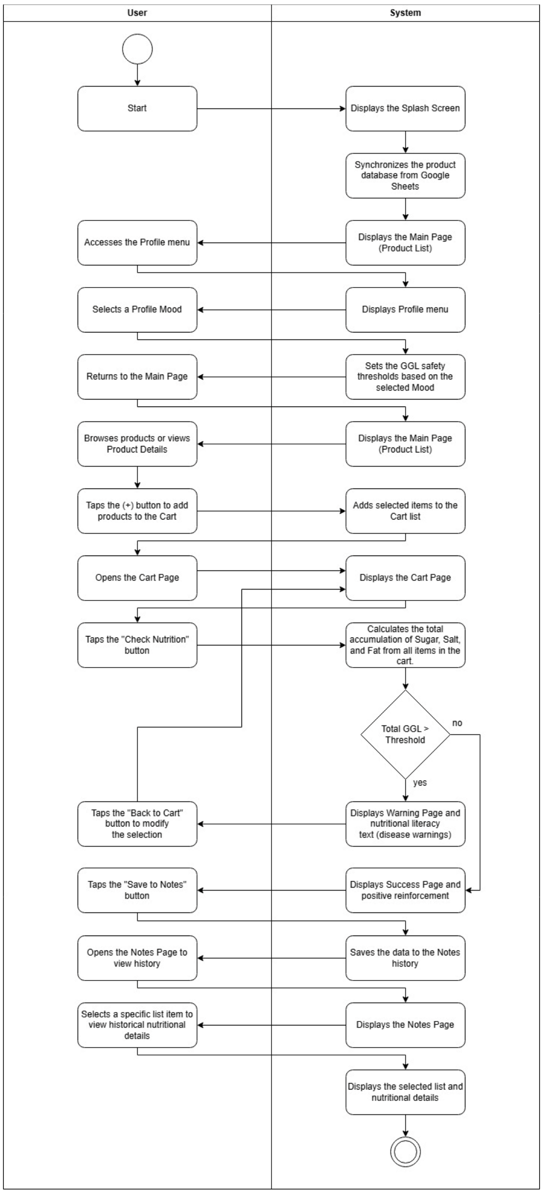

Figure 3. Activity Diagram of the GGL filtering logic and user navigation flow

The core logic of the activity occurs at the decision node during the "Check Nutrition" phase. If the cumulative total of sugar, salt, or fat exceeds the predefined limits (based on Permenkes No. 30 of 2013 or the chosen health mood), the system triggers a "Warning Page" to provide nutritional literacy and disease risk education. This creates a feedback loop, requiring housewives to modify their cart selection until the intake is within safe boundaries. Once validated, the system directs housewives to the "Success Page" and provides the option to archive the healthy shopping simulation into the history notes.

3.3 User Interface

The user interface of the "Sendok Sehat" application is designed with a focus on simplicity and accessibility for housewives. The implementation uses the Kotlin programming language to ensure a responsive experience on Android devices. Below are the key pages of the application:

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3.3.1 Splash Screen

Figure 4. Splash Screen interface during database synchronization with Google Sheets

Figure 4 shows the Splash Screen as the initial interface displayed when the housewife launches the application. It serves as a visual introduction while the system performs an automated background task to synchronize the snack database from Google Sheets. This ensures that the nutritional data and product prices remain consistent with the latest updates from the cloud database before the housewife enters the main menu.

3.3.2 Home Page

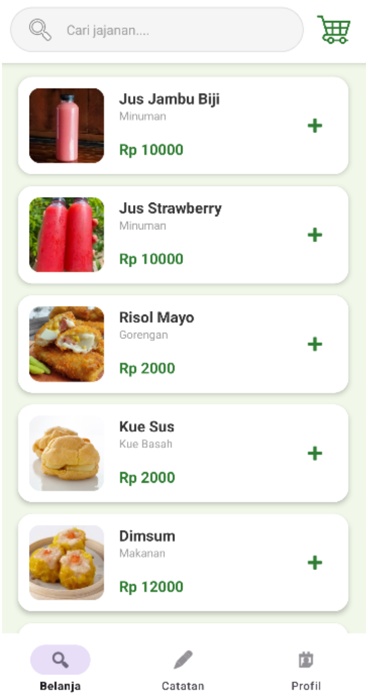

Figure 5. Home Page interface featuring the traditional snack marketplace simulation

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Figure 5 shows the Home Page as the primary marketplace simulation where housewives can browse various traditional snacks. We designed this page to display a list of products in a clean grid format, featuring clear images and prices to provide a familiar e-commerce experience.

3.3.3 Profile Page

Figure 6. Profile Page for managing personalized health "Mood" and GGL thresholds

Figure 6 shows the Profile Page, where housewives can manage their personal health goals through the "Mood" feature. This setting allows the user to select specific preventive health modes, which will programmatically adjust the GGL limits used by the system during the cart validation process.

3.3.4 Product Detail Page

Figure 7. Product Detail Page displaying nutritional information in Household Measures (URT)

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Figure 7 shows the Product Detail Page, this page provides a deeper layer of nutritional literacy by displaying high-quality product images, names, prices, and detailed nutritional values. The nutritional information is presented in Household Measures (URT), accompanied by a description to help housewives understand the content of each snack before adding it to the cart.

3.3.5 Shopping Cart Page

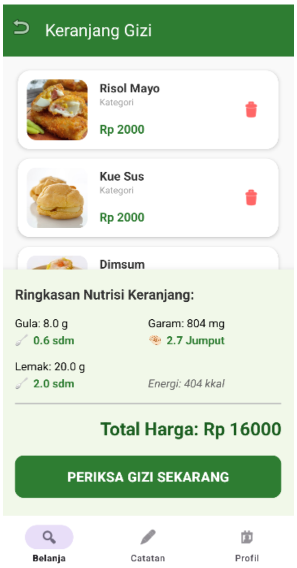

Figure 8. Shopping Cart Page with real-time accumulation of Sugar, Salt, and Fat data

Figure 8 shows Shopping Cart Page, this page displays all selected items and provides a real-time calculation of the total price and accumulated nutritional values (Sugar, Salt, and Fat). This page is critical as it serves as the final step before the system performs the GGL threshold validation logic.

3.3.6 Warning Page

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Figure 9. Warning Page triggered by the system when GGL safety limits are exceeded

Figure 9 shows the Warning Page, this page is the core literacy medium that appears if the shopping cart exceeds the safety limits of Permenkes No. 30 of 2013 or the chosen health mood. It provides direct nutritional education regarding the risks of excessive consumption and encourages housewives to revise their food choices.

3.3.7 Success Page

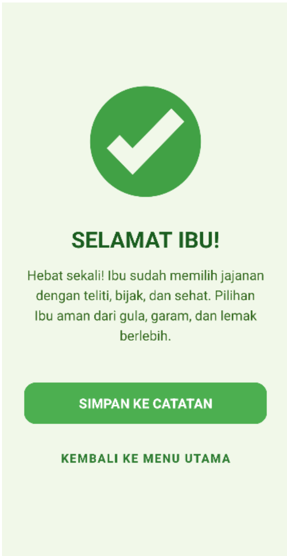

Figure 10. Success Page confirming that the snack selection is within healthy thresholds

When the user's selection is within the healthy threshold, the Success Page in Figure 10 displayed. This page provides positive reinforcement by confirming that the user has made healthy food choices, thereby encouraging a sustainable healthy lifestyle.

3.3.8 Notes Page

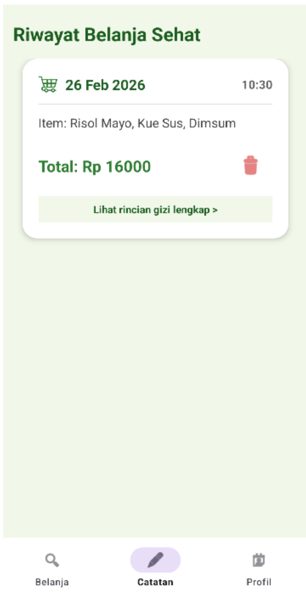

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Figure 11. Notes Page displaying the chronological history of saved shopping simulations

Figure 11 shows the Notes Page, this page displays a chronological list of saved shopping simulations. Each entry is labeled with the specific date and time the simulation was completed, allowing housewives to track their progress.

3.3.9 Note Detail Page

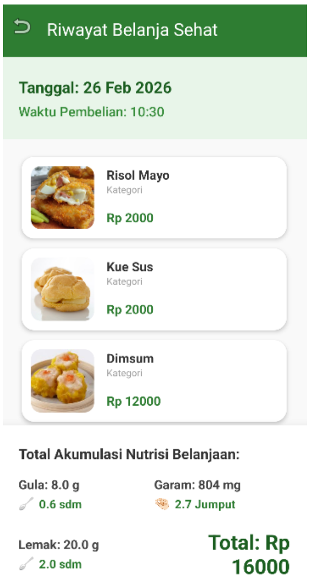

Figure 12. Note Detail Page showing a comprehensive breakdown of previous healthy selections

When a user selects an entry from the history list, the Note Detail Page in Figure 12 displayed. This view includes the exact timestamp, the list of products selected, total price, and the final nutritional breakdown of that specific simulation for review.

3.4 Testing

Black Box Testing was conducted to verify the critical functionalities of the "Sendok Sehat" application, including database synchronization with Google Sheets, mood profile configuration, and the accuracy of the GGL filtering logic. A total of 8 test scenarios were executed to evaluate the system. The testing process involved simulating user interactions from product selection to transaction validation, and comparing the actual outputs against the health standards defined by Ministry of Health Regulation No. 30 of 2013.

Table 1. Results of Functional Validation using Black Box Testing with 8 Test Scenarios

Test Case	Test Steps	Expected Results	Evaluation Result
Database Synchronization	Open the application (Splash Screen)	System successfully fetches and updates product data from Google Sheets API	Successful
Mood Profile Selection	Select a specific health mood (e.g., Prevent Diabetes)	System correctly sets and saves the GGL threshold based on the selected mood	Successful

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Product Detail View	Click on a snack item from the home list	Detailed nutritional info, URT measurements, and product description are displayed	Successful
Add to Cart	Tap the (+) button on multiple products	Products are added to the list, and the cumulative total of Price and GGL is calculated	Successful
GGL Filter Logic (Exceed Limit)	Proceed with a cart total exceeding 50g Sugar / 2000mg Salt / 67g Fat	System intercepts the transaction and displays the Warning Page with literacy content	Successful
GGL Filter Logic (Within Limit)	Proceed with a cart total below the safety threshold	System approves the transaction and displays the Success Page	Successful
Save History Note	Click the "Save to Notes" button on the Success Page	Data (Date, Time, Product List, GGL totals) is stored in the local history database	Successful
View History Detail	Select an entry from the History List	System displays the exact details of the previous healthy shopping simulation	Successful

The results of the black box testing phase, as presented in Table 1, confirm a 100% success rate across all 8 scenarios. The application's functional requirements are fully met, particularly the "Warning Page" trigger which serves as the primary nutritional literacy intervention. By identifying and resolving potential discrepancies between user input and nutritional calculations, the system ensures a reliable and accurate educational experience. Consequently, the application maintains high objectivity in monitoring sugar, salt, and fat intake, providing a robust digital tool to support housewives in making healthier dietary decisions for their families.

4. CONCLUSION

The development of the "Sendok Sehat" application using the Multimedia Development Life Cycle (MDLC) methodology has successfully provided a practical solution for enhancing nutritional literacy among housewives. By integrating the standards of Ministry of Health Regulation No. 30 of 2013 into a familiar e-commerce-style interface, the application bridges the gap between complex health regulations and daily food shopping simulations. The implementation of Android Studio, Kotlin, and Google Sheets as a database has resulted in a responsive system capable of real-time GGL (Sugar, Salt, Fat) monitoring. Functional validation through Black Box Testing confirms that the application operates with a 100% success rate across all tested scenarios, particularly in the core logic of triggering the "Warning Page" when GGL thresholds are exceeded and displaying educational content.

The application serves as an effective digital medium to educate housewives on the dangers of excessive GGL intake, such as hypertension, diabetes, and stroke, through its interactive "Warning" and "Success" feedback system. By converting nutritional grams into Household Measures (URT) like spoons or pinches, "Sendok Sehat" significantly simplifies health data for housewives. However, this study has limitations, such as a database currently focused only on specific traditional snacks and the manual entry of product data. Future research and development should consider integrating real-time barcode scanning for packaged products and expanding the database to include a wider variety of local cuisines to further strengthen household food security and public health outcomes.

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