

Design of an Android-Based Mobile Application for Nutritional Consultation and Status Monitoring

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Abstract: Access to and awareness of nutritional health services in Indonesia play a crucial role in preventing various diseases in children and adults. This study develops an Android-based application aimed at enhancing access to nutritional information and consultation services, as well as promoting effective nutritional management methods. The application was developed using the Waterfall methodology, encompassing stages of requirements analysis, design, implementation, testing, and maintenance, to ensure that the resulting application meets the specified requirements and provides optimal solutions for nutritional consultation and monitoring. The application is designed to meet the needs of users and nutrition experts through features such as registration, consultation, and a Body Mass Index (BMI) calculator. Developed using Android Studio, MySQL, and XAMPP, the application was tested on various Android devices and demonstrated stable and smooth performance. Ongoing maintenance is implemented to ensure continuous optimal functionality. The application also features the selection of nutrition experts according to user preferences and a BMI calculator that allows users to independently check their nutritional status. Compatible with Android Oreo and later versions, the application requires an internet connection to optimize all functionalities, including consultation services and content updates. This application is expected to improve accessibility and individual awareness of nutritional health services in Indonesia.

Keywords: Android; Mobile Application; Nutrition Education; Nutrition Consultation; Health Technology.

1. Introduction

Nutrition is a critical component of food, essential for growth, body maintenance, and health. The significance of nutrition has been recognized since the 19th century when a French scientist named François Magendie developed methods to identify the main nutritional components in food, such as proteins, fats, and carbohydrates. Generally, nutrition encompasses the essential substances the body needs to maintain health, perform daily functions, and ensure overall well-being [1]. Nutritional status refers to the health condition influenced by the intake and utilization of nutrients. The World Health Organization (WHO) describes nutritional status as the balance between nutrient intake from food and the body's needs to maintain healthy functioning and activity levels [2]. A person is considered to have good nutritional status if their nutrient intake meets established health standards. According to Rudi Sumarlin [3], nutritional status reflects an individual's health condition based on their daily nutrient consumption. There are benchmarks for adequate nutrition and thresholds for nutritional deficiencies. Poor nutrition can increase the risk of various health issues, such as hypertension, osteoporosis, and heart disease [4]. In children, inadequate nutrition can lead to serious problems such as stunted growth, commonly referred to as stunting, which is prevalent in many regions, including Indonesia [5]. Despite the clear role of nutrition in maintaining health, many individuals remain unaware of its importance. Often, people avoid seeking nutritional consultations due to various barriers, such as distance, long waiting times, or associated costs. However, nutritional consultations are crucial for optimizing health and preventing diseases. The 2021 Indonesia Nutritional Status Survey (SSGI) reported that Bali was the only province in Indonesia meeting WHO standards for nutritional health, with a stunting rate as low as 10.9%. This highlights the need for improved access and awareness regarding nutritional health services across Indonesia.

The challenges related to nutritional health in Indonesia are diverse, including low public awareness, limited access to nutritional information, and insufficient consultation services. These conditions highlight the need for innovative solutions to enhance public access to nutritional information and professional advice. Mobile health technologies, particularly those delivered through accessible platforms like Android, offer significant potential to address these gaps. In response to the issues of nutritional deficiencies and barriers to professional consultation, a novel Android-based application has been developed. This application is designed to facilitate user engagement with nutritional information and services, enabling individuals to consult with nutrition experts, access reliable information on dietary management, and adopt strategies to maintain optimal nutritional health. The primary objective of the application is to bridge the gap between individuals and nutritional health services, thereby enhancing awareness and proactive health management. The development of this mobile application utilizes the Waterfall methodology, a linear and sequential approach commonly used in software development projects. The Waterfall model involves several distinct phases: requirements analysis, system design, implementation, integration and testing, and maintenance. Each phase must be fully completed before proceeding to the next, ensuring that the resulting application meets all predefined specifications and requirements. This method is particularly suitable for projects with clearly defined goals from the outset, as it allows for thorough planning and orderly progression through each stage of development. The application is tailored to meet the needs of both users and nutrition professionals, featuring functionalities such as registration, personalized consultations, and a Body Mass Index (BMI) calculator. Developed using Android Studio, MySQL, and XAMPP, the application has undergone rigorous testing across various Android devices, demonstrating stable and smooth performance. The BMI calculator, in particular, empowers users to independently assess their nutritional status by inputting their weight and height, providing immediate feedback on their health metrics.

Compatibility with Android Oreo and newer versions ensures that the application can be utilized on a wide range of devices, making it accessible to a broad audience. Internet connectivity is required to fully leverage the application's functionalities, including real-time consultations and content updates. The application is designed to be user-friendly, offering a selection of nutrition experts according to user preferences, which enhances the consultation experience by providing advice tailored to individual needs. By integrating technology into nutritional health services, this application aims to improve individual and community access to essential health resources in Indonesia. It is anticipated that the widespread adoption of this application will contribute to better nutritional outcomes, reduce the incidence of nutrition-related diseases, and ultimately improve public health. As the application continues to evolve with ongoing maintenance and updates, it is expected to remain a valuable tool for enhancing nutritional awareness and engagement among the population.

2. Research Method

2.1. Waterfall Methodology

The Waterfall methodology was applied in the design and development of the application using a structured and systematic approach [6]. Each stage of this methodology is carried out sequentially, starting from planning, requirements analysis, system design, implementation, integration and testing, to maintenance [7]. This approach ensures that each phase must be fully completed before proceeding to the next, resulting in a well-designed and purpose-built application that adheres to the established specifications [8].

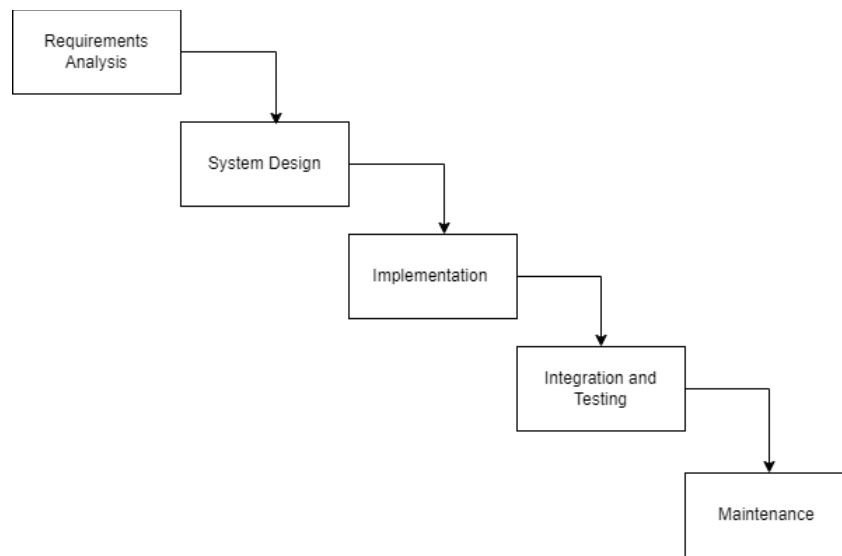


Figure 1. Waterfall Method

When using the Waterfall methodology in software development, several stages must be carefully considered. As illustrated in the above diagram, this process includes steps beginning with initial planning, followed by requirements analysis, system design, implementation or coding, testing, and concluding with maintenance. A detailed explanation of each stage of the Waterfall methodology is provided in the points below.

1) Requirements Analysis

The first stage, requirements analysis, involves evaluating and identifying consumer needs accurately [9]. This process includes not only direct interviews with potential users but also observations of user behavior in real-world contexts and the analysis of relevant data to understand specific nutritional needs. The outcome of this evaluation encompasses all criteria required for software development, including detailed documentation of system requirements that specify technical, functional, and non-functional specifications for the software [10]. This ensures that the designed application will provide precise solutions for effective and efficient nutritional consultation and monitoring.

2) System Design

System design is a critical step following the completion of the requirements analysis. In this second stage of the Waterfall methodology, the development team strategically outlines the system architecture with greater detail. The design encompasses the structure of data, software modules, and user interfaces, while also considering data security, system scalability, and integration with other health services. This design must meet all requirements identified during the analysis phase, including both functional and non-functional needs. The documentation generated at this stage serves as an essential reference for developers during the coding phase [11]. A thorough and detailed design ensures that the developed application can deliver intuitive, accurate, and easily accessible consultation and monitoring services for nutritional status.

3) Implementation

Implementation is the third stage of the Waterfall methodology, where the carefully crafted system design from the previous stage is translated into program code [12]. During this phase, software developers begin coding according to the established design specifications, focusing on creating functions and modules that are responsive to the deeply analyzed user needs. This phase also includes rigorous unit testing to verify that each part of the code functions correctly and meets expectations. This ensures that

the integrated system will operate without obstacles and aligns with the initial development goals of providing a reliable platform for nutritional consultation and monitoring [13]. As a result, the application produced is not only functional but also intuitive and easy for users to navigate, enhancing the effectiveness and efficiency of nutritional status monitoring.

4) Integration and Testing

Integration and testing represent crucial stages of the Waterfall methodology, where all software components developed during the implementation phase are integrated into a unified system. This process ensures smooth interactions among application components and consistency with the system design established earlier [14]. Additionally, this stage involves comprehensive testing to identify and resolve bugs or other issues that may arise. Testing is not limited to functional testing but also includes regression testing, system testing, security testing, and compatibility testing to ensure that the application performs well across various devices and Android versions. This guarantees that the developed application meets the specified requirements and is reliable for users seeking nutritional consultation and monitoring [15]. Thus, the resulting application becomes an effective and efficient tool in assisting users to monitor and improve their nutritional status.

5) Maintenance

Maintenance is the fifth and final stage of the Waterfall methodology, playing a vital role in ensuring that the application remains relevant and effective. After the software has been integrated, tested, and deployed, the maintenance phase begins, focusing on monitoring the application's performance in real operational environments. During this stage, the development team actively addresses emerging issues, including bugs or security vulnerabilities, and implements updates that not only enhance performance but also adapt the application to evolving user needs and the latest technological trends. Maintenance is crucial to ensure the long-term reliability and sustainability of the software, allowing the nutritional consultation and monitoring application to continue being a valuable tool for users in maintaining and improving nutritional health [16].

2.2. Research Framework

This study adopts a consultation-based approach as its core structure, utilized by patients to interact with and receive recommendations from doctors or nutrition experts. This approach leads to the formation of research questions focused on simplifying consultations with nutrition experts and providing nutritional information to address malnutrition issues. Consultations are necessary to help patients better understand the nutritional issues they face and provide expert guidance that is available anytime and anywhere. Through this application, patients can engage in dialogue with nutrition experts using various features, including text messaging, voice calls, and video calls. Additional features such as a nutritional status calculator and related articles are also available, where users receive expert advice based on a series of questions posed by the system. The goal of this research is to raise public awareness of the importance of nutritional balance and enable efficient consultations without complex procedures.

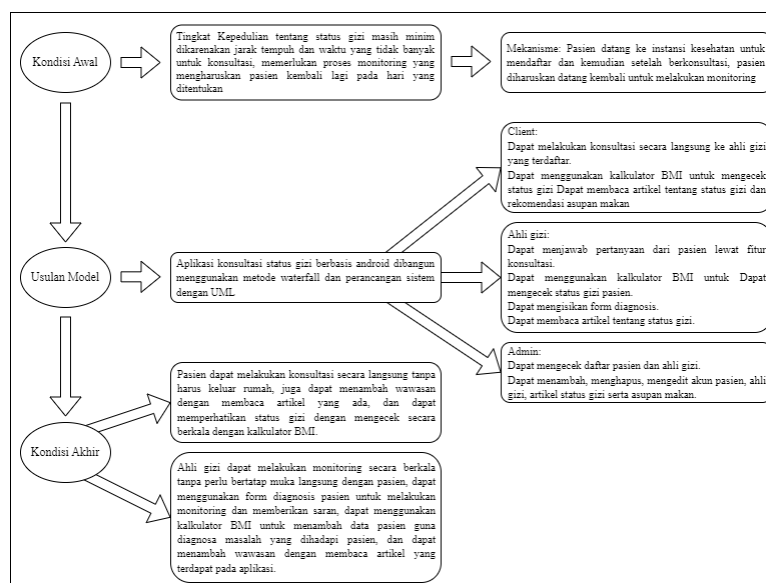


Figure 2. Research Framework

3. Result and Discussion

3.1 Results

3.1.1. Requirements Analysis

The requirements analysis conducted for the development of the nutritional consultation and monitoring application includes both functional and non-functional aspects to ensure the application serves as an effective tool for users. The functional requirements of the application encompass three main areas: input needs, necessary processes, and desired outputs. The developed application requires several types of input data to function properly. Users must first register and log into the system before accessing its features, allowing them to interact directly with nutrition experts. Administrators are responsible for inputting information about nutrition experts and relevant articles into the system. Nutrition experts can log into the application using credentials provided by the administrator. Additionally, the application includes a BMI calculator that requires users to input their weight and height to calculate their Body Mass Index (BMI). The processes involved in this application include efficient data storage and information management. The system is designed to securely store health articles, user data, and nutrition expert information within a database. User queries and the responses from nutrition experts are also stored in the system. For the BMI calculator, the application uses the standard BMI formula to calculate BMI based on the input data provided by the user:

$$BMI = \frac{Weight (kg)}{Height (m)^2}$$

The outputs expected from the application are designed to be beneficial for users. Users can consult with nutrition experts online, avoiding queues and physical visits to health facilities. The nutrition calculator allows users and experts to check nutritional status, and the available articles aim to enhance knowledge and serve as additional resources. Nutrition experts also benefit from the diverse experiences gained through consultations with clients presenting varied cases. The non-functional requirements of the application are divided into software and hardware specifications. For software, the application requires Android Studio Electric Eel 2022.1.1, MySQL 8.0.31, and XAMPP 8.1.10 for development and testing. For hardware, the application needs specific requirements for optimal performance, including a smartphone processor speed of 1.2 GHz, at least 2 GB of RAM, 8 GB of ROM, and a minimum Android Lollipop 5.0 operating system.

3.1.2. System Design

The system design process aims to detail the concept of the planned nutritional consultation application system. This is achieved through the use of use case diagrams and a NoSQL Firebase database. The process also includes the creation of initial interface designs represented by wireframes. A use case diagram is a modeling method that illustrates the interactions between the planned information system and its users. This method identifies the functions within the information system and determines the entities with access rights to these functions [17]. The use case diagram presented below shows the structure of the system being designed.

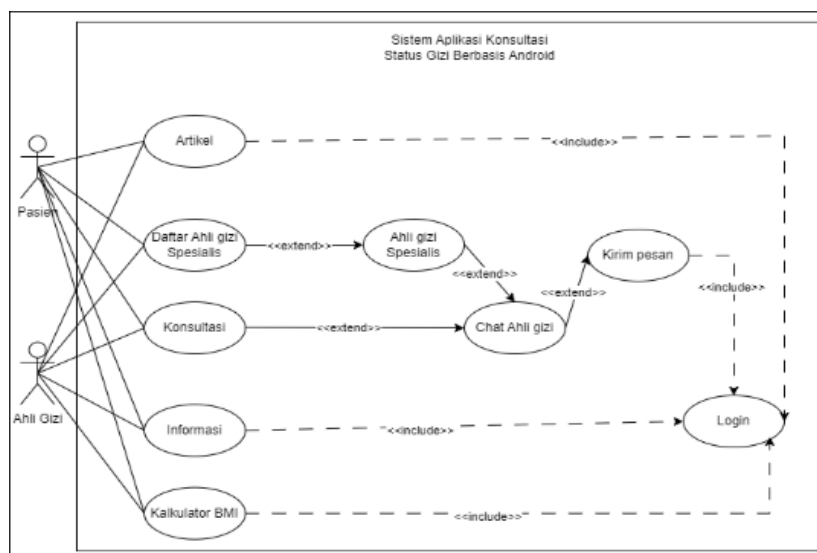


Figure 3. Use Case Diagram

The diagram shows that the actors involved in the system are Patients and Nutrition Experts. Patients can access various features such as reading Articles, viewing the List of Nutrition Specialists, conducting Consultations, obtaining Information, and using the BMI Calculator. To access these features, patients must first log in. Nutrition Experts have access to these features with the added ability to send messages and chat with patients. The "List of Nutrition Specialists" and "Consultation" features are linked to the "Chat Nutrition Expert" feature, enabling direct communication between patients and nutrition experts. The "Send Message" feature, used by nutrition experts to communicate with patients, is also included in the system. This diagram provides a clear overview of the interactions between actors and the system, as well as the relationships between features, facilitating the understanding of the system's flow and requirements.

NoSQL Firebase is a cloud-based database platform designed to facilitate real-time data storage and synchronization among users. This platform offers high flexibility and scalability, making it suitable for responsive and efficient application development [18]. With the capability to handle rapid data changes, NoSQL Firebase is an ideal solution for applications that require instant information exchange.



Figure 4. NoSQL

The diagram above shows the structure of the NoSQL database used in the Android-based nutritional consultation application. The database is organized in a hierarchical format with two main nodes: "chats" and "userreg." The "chats" node stores conversation data between patients and nutrition experts, where each conversation is identified with a unique ID. Within each conversation ID, there are subnodes "messages" that store details such as message content, timestamp, and UID (user identification of the message sender). An example of the message structure shows that each message has its unique ID. The "userreg" node stores user registration data, where each user is identified with a unique UID. Within each user UID, detailed information such as email, type, full name, password, and username is stored. This hierarchical database structure allows for organized data management, facilitating access and manipulation of data as needed by the application, such as displaying conversation histories or quickly managing user information. The presented interface design serves as a framework for the application's layout. The wireframe creation process is carried out before application development, aiming to visualize the process flow and page layout to be built, specifically for the Nutritional Status Consultation Application on the Android platform.

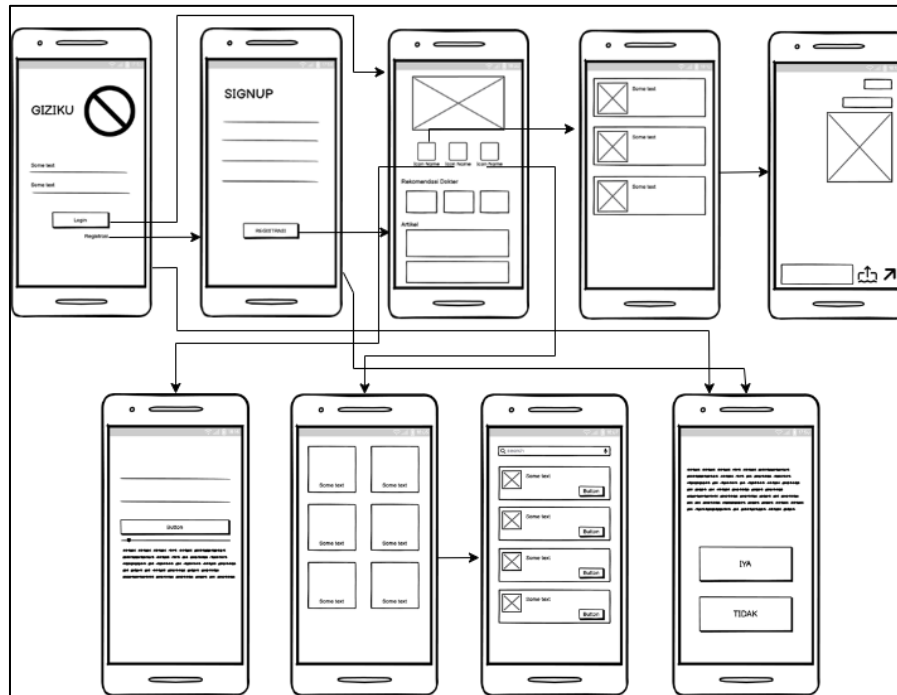


Figure 5. Application Wireframe

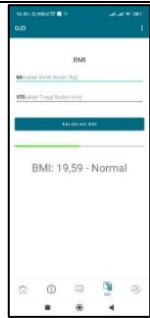
The image above shows the wireframe of the application's interface design, consisting of several main screens. The first screen is the login screen with a "Login" button and a "Register" hyperlink. Users can enter their credentials to log in or register if they do not have an account. The signup screen allows users to register by entering information such as name, email, and password, and then pressing the "Register" button. After logging in, users are directed to the home screen, which displays various options such as doctor recommendations and articles, providing quick access to various application features. The article list screen displays a list of articles that users can read, shown in card format that can be selected for further reading. The consultation screen allows users to enter questions or nutritional complaints to be sent to nutrition experts and provides information on consultation procedures or details. The nutrition expert list screen displays available nutrition experts, each shown in card format with brief details. The conversation screen shows ongoing consultations between users and nutrition experts, with options to continue or end the conversation. Finally, the confirmation screen displays confirmation messages for certain actions, with options to select "YES" or "NO." This wireframe provides an overview of the navigation flow and user interface elements within the application, aiding in the design and development of the application.

3.1.3. Implementation

The implementation stage involves programming the system design concept that has been carefully crafted in the previous stages. In this study, Android Studio is used as the application development software. Android Studio is an open-source Integrated Development Environment (IDE) for developing Android applications [19]. The study also uses Kotlin programming language to develop the application. Kotlin is a programming language designed to run on the Java Virtual Machine (JVM). With a practical approach, Kotlin unifies object-oriented and functional programming concepts, particularly for Android application development [20]. The advantage of Kotlin lies in its ability to work with Java, allowing both to be used together in one project. Additionally, Kotlin is suitable for creating desktop applications, websites, and backend solutions. The system uses MySQL as the system database. MySQL is an open-source relational database management system (RDBMS) that uses SQL (Structured Query Language) to manage data organized in tables [21]. Below are the results and descriptions of the system implementation.

Table 1. Implementation Results

Results	Description
	The application login page displays the application logo and name at the top, with relevant illustrations. Users can enter their email and password in the two text fields provided, then press the "LOGIN" button to access the application. The "Don't have an account? Register" link below the login button allows new users to register.
	The application registration page displays the title "Signup" at the top. Users are asked to enter information such as full name, email, username, and password in the text fields provided. After filling in the information, users can press the "REGISTER" button to create an account.
	The application dashboard page, at the top of which there is a banner with a picture of healthy food that displays important information or promotions. Below it, there are several categories such as "Nutrition Articles" and "Nutritionists" with easily recognizable icons. The screen also displays a list of articles with images and titles that can be scrolled vertically. At the bottom, there is a navigation menu with icons for the main features of the application such as home, search, consultation, and user profile, allowing quick and easy access to various parts of the application.
	The app's consultation page displays a list of nutritionists available for consultation, each with a profile icon and name. At the bottom, there is a navigation menu with icons for the app's main features, including home, search, consultation, and user profile.
	The doctor chat page in the app displays the doctor's name and an icon to contact the doctor at the top of the screen. The middle of the screen displays the conversation, with a chat bubble containing the message from the user and the doctor. Below the message, there is an image and description of the project or relevant information. At the bottom of the screen, there is a text field to write a message and a send icon to send the message. The navigation menu at the bottom provides quick access to the main features of the app, such as home, search, consultation, and user profile.



This BMI page displays the title "BMI" at the top. The user enters weight in kilograms (kg) and height in centimeters (cm) in the fields provided. After that, the user presses the "CALCULATE BMI" button to get the calculation results. The BMI results are displayed below the buttons, for example "BMI: 19.59 - Normal", indicating that a BMI value of 19.59 is included in the normal category. At the bottom of the screen are navigation icons for other features in the application, such as home, graphs, statistics, and settings.



The specialist doctor page displays various nutrition-related health services. Users can choose from several options such as Maternal and Child Nutrition, Clinical Nutrition and Disease, Sports and Fitness Nutrition, Weight Management, Nutrition Counseling, Community Nutrition, Nutrition for Chronic Diseases, and Special Diets and Food Allergies. Each service is presented in the form of an icon and a short description. At the bottom of the page there are also navigation icons to switch to other features in the application, such as home, graphs, statistics, and settings.



The page displays a list of available specialist doctors. There is a search field at the top to make it easier for users to search for doctors by name. Each doctor entry is equipped with a "START CONSULTATION" button that allows users to start a consultation with the doctor. At the bottom of the screen, there are navigation icons to access other features in the application.



The question page in the middle of the screen has a question text that reads, "Hello, Are you pregnant or breastfeeding?" Below this question, there are two large and clear choice buttons, namely "YES" and "NO." This page functions to display doctor recommendations on the homepage according to the questions that appear and the answers given by the user.

3.1.4. Testing

The testing phase is used to identify and fix bugs or other issues that may arise within the system. This study employs the black box testing method, a software testing technique that evaluates the application's functionality without requiring knowledge of the internal code, structure, or system implementation [22]. This testing is based on the functional specifications and requirements, with the testing process carried out by providing input and examining the output produced. This technique is effective in identifying errors in interfaces, function faults, data structure or database access errors, and performance issues within the software product [23]. Black box testing helps ensure the application performs as expected by end users. Testing will be conducted on two types of Android devices with different specifications. The selection of these devices aims to verify that the application functions well under various hardware conditions. Details of the devices used in the testing are shown in the table below.

Table 2. Testing Devices

No	Device Name	Android Version	RAM	Storage
1	Redmi Note 10 Pro	12	8 GB	128 GB
2	Oppo A5s	8.1.0	3 GB	32 GB

Following the testing on various Android devices, the results of the system test are shown in the table below.

Table 3. Testing Results

No.	Test Type	Test Description	Result (Redmi Note 10 Pro)	Result (Oppo A5s)
1	Registration Button Test	Able to navigate to the registration page	Valid	Valid
2	User Registration Button Test	Able to register an account and save user data into the database	Valid	Valid
3	Login Button Test	Able to log in and access the home screen using registered Email and Password	Valid	Valid
4	Article Feature Test	Able to switch to the selected article page	Valid	Valid
5	Navbar Test	Can be used to navigate to other Activities	Valid	Valid
6	Doctor Chat Button Test	Able to switch to the consultation Activity	Valid	Valid
7	Typing and Sending Message Test	Able to type and send messages	Valid	Valid
8	Receive Text Message Test	Able to receive text messages and display them	Valid	Valid
9	Image Selection and Send Button Test	Able to open smartphone storage, select images, and send them	Valid	Valid
10	Receive Image Message Test	Able to receive and display image messages	Valid	Valid
11	Voice Call Button Test	Able to switch to the smartphone's voice call with the registered doctor's number	Valid	Valid
12	Specialist Doctor List Button Test	Able to display the specialist doctor list options	Valid	Valid
13	Specialist Doctor Feature Test	Able to display saved doctors with registered specializations	Valid	Valid
14	First-Time Login Question Test	Displays questions and answer buttons	Valid	Valid
15	Answer Choice Button Test	Able to select answers correctly	Valid	Valid
16	Doctor Recommendation Test	Displays doctor recommendations based on user answer choices	Valid	Valid
17	BMI Calculator Feature Test	Able to input height and weight, calculate, and display the BMI calculation result	Valid	Valid

From the above testing results on two Android smartphones, the Redmi Note 10 Pro showed a quick response when the login button was pressed, immediately switching to the dashboard page. Meanwhile, the Oppo A5s experienced a delay in navigating to the dashboard after login. Both smartphones encountered a bug where selected images were not displayed unless they were already in local storage. This bug was due to errors in the developed code. Aside from this issue, all other features worked well on both devices. However, on the Oppo A5s, the UI appeared larger due to the smaller screen resolution compared to the Redmi Note 10 Pro.

3.1.5. Maintenance

The final stage in system development is the maintenance process that will be conducted in the future. The maintenance process includes several critical aspects. First, regular updates must be performed to ensure the application remains compatible with the latest Android versions and various hardware configurations. Second, real-time monitoring of application performance helps identify and address issues encountered by users. Third, collecting user feedback is essential for improving functionality and user interface. Lastly, user data security must always be a priority, ensuring data encryption and compliance with data protection regulations. By addressing these aspects, the application can continue to evolve and provide long-term value to users.

3.2 Discussion

Based on the results of the requirements analysis and system design, the nutritional consultation and monitoring application has been designed to meet both functional and non-functional requirements. The application allows users to register, log in, and utilize features such as consultations with nutrition experts and a Body Mass Index (BMI) calculator. Efficient data storage and robust information management ensure reliable consultation services and information delivery. Additionally, users can access health articles available within the application as an extra educational resource, while nutrition experts can use the application to handle various cases and enhance their professional experience.

During the implementation phase, the application was developed using Android Studio, MySQL, and XAMPP, ensuring that development and testing were carried out with appropriate tools. Testing was conducted to ensure the application performs well on devices with minimal specifications, including 3 GB of RAM, 32 GB of ROM, and Android Lollipop 8.1.0 as the operating system. The testing results indicate that the application operates smoothly and meets user requirements. Maintenance plans are also in place to keep the application updated with the latest information and technology, and to address any bugs or issues that may arise during use. Therefore, the application is expected to continue providing maximum benefits for both users and nutrition experts. The successful implementation of this application demonstrates the viability of mobile health solutions in addressing nutritional consultation needs. The ability to interact with nutrition experts directly through the app and utilize tools like the BMI calculator provides users with immediate, actionable insights into their nutritional health. Moreover, the inclusion of educational articles offers users additional knowledge resources, thereby supporting informed decision-making regarding their nutritional practices.

The testing outcomes on different devices confirm the application's capability to function effectively across a range of hardware conditions, reinforcing its accessibility and usability for a broad audience. This adaptability is critical for ensuring that the application can serve users regardless of the specific devices they have access to, thereby enhancing its overall reach and impact. Future maintenance and updates are essential to sustain the application's relevance and effectiveness. Regular updates will not only keep the app compatible with newer Android versions and emerging technologies but also improve the user experience by refining existing features and adding new functionalities based on user feedback. This proactive approach to maintenance will help in swiftly addressing any potential security vulnerabilities and operational inefficiencies, thus safeguarding the application's integrity and user trust. The nutritional consultation and monitoring application has been thoughtfully designed and meticulously implemented to serve as a valuable tool for both users seeking nutritional guidance and professionals providing expert advice. Its continued evolution through diligent maintenance will ensure that it remains a reliable and effective resource in the pursuit of better nutritional health for all users.

4. Related Work

This study builds upon several relevant prior works that serve as foundational references in the development of the system. The first related research was conducted by Hayatin *et al.* (2019), who developed a mobile application for lactation guidance and online consultation, providing information on daily breast milk requirements, feeding frequency, and the working hours of mothers. However, the application had limitations due to the absence of a global consultation feature, as it was not connected to the internet, restricting its accessibility and usability on a broader scale [24]. Another study by Ridho *et al.* (2021) developed a web-based application for nutritional consultation. The system provided information based on gender, age, body weight, height measurements, and daily physical activities. Despite its contributions, the system was limited by its inability to detect the nutritional content of foods and lacked interactive features such as sharing or liking articles [25]. Santoso *et al.* (2022) also explored the development of a health consultation application

using React Native. While innovative, the application was deficient in that it did not support the functionality for users to provide and view reviews of registered doctors and hospitals, which is critical for enhancing user satisfaction and trust [26].

Iqbal and Husin (2017) developed an online web-based nutritional consultation application that provided information on Body Mass Index (BMI) using the Harris-Benedict formula and listed nutrition experts for users. However, the application was constrained by its chat feature, which lacked real-time capabilities, limiting its effectiveness in providing comprehensive and continuous information that is accessible around the clock [27]. Lastly, Primasari (2018) developed a web-based expert system application for diagnosing nutritional disorders. The main drawback of this application was that it relied on a manual method for data entry, which can be time-consuming and prone to errors [28].

These studies highlight various approaches and technologies used in the development of nutritional and health consultation applications, each with distinct features and limitations. The findings and limitations of these studies underscore the need for an integrated and accessible solution that provides reliable, real-time consultation services, seamless user interaction, and comprehensive nutritional information management. By addressing these gaps, the current study aims to enhance the functionality and user experience of nutritional consultation applications through the development of a robust, internet-connected Android-based platform that includes real-time interaction capabilities, comprehensive data handling, and continuous availability to meet users' needs effectively.

5. Conclusion

The developed application aims to streamline the nutritional consultation process by providing easy access to specialized nutrition experts. With the expert selection feature, users can tailor their search based on specific needs and personal preferences. The nutrition expert recommendations available within the application are designed to guide users towards appropriate choices, ensuring that they receive high-quality and condition-specific advice. Furthermore, the application facilitates direct consultations with registered nutrition experts, promoting efficient information exchange and providing the necessary support for optimal nutritional management. The integrated BMI calculator within the application supports users in independently diagnosing and monitoring their nutritional status, equipping them with the tools to better manage and monitor their health. The application's compatibility with Android Oreo and newer versions ensures that users can access the application on a wide range of devices with optimal performance. Internet access is a key requirement to fully utilize all the features offered, including content updates and interactions with nutrition experts, ensuring that users are always connected to the latest information and resources in the field of nutrition. Thus, this application not only serves as a consultation tool but also acts as a valuable health companion on the journey towards a healthier and more informed lifestyle. By integrating user-friendly features and ensuring broad accessibility, the application empowers users to make informed decisions about their nutritional health, promoting sustainable and personalized health management practices.

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