

## Digitalization of Restaurant Services Android-Based Menu Ordering Application Using Waterfall Method

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### ABSTRACT

Utilization of mobile application technology which can be one of the considerations for presenting information in various business actors because of its flexible and easy nature. One of them is the Betawi Babeh Sadeli Restaurant which is currently still implementing a manual ordering method, the waiter records the menu to be ordered, then delivers the order to the kitchen which requires a lot of time and effort. From these problems, the authors provide a solution for designing a food menu ordering application for Android-based mobile devices with the waterfall method. This study aims to design a real-time food menu ordering system for Android-based mobile devices using the waterfall method. The developed application streamlines the ordering process at the Betawi Babeh Sadeli Restaurant. Functionality testing results indicate that 92% of the application features functioned correctly, demonstrating its effectiveness and reliability.

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## 1. INTRODUCTION

The utilization of technology today has developed at an incredible pace. The convenience provided by technological facilities can support human needs in completing various tasks. One of the current uses of technology is mobile applications. Mobile applications, which are easier to operate and are inherently flexible, have become a key consideration for businesses in choosing a medium for delivering information. One such case is Rumah Makan Babeh Sadeli, which seeks to leverage technology to streamline its operational processes, particularly in food ordering.

Currently, Rumah Makan Babeh Sadeli still uses a manual ordering system, where the waiter takes the customer's order by writing it down and then forwards it to the kitchen and cashier. This manual process can lead to errors and requires significant time and effort, which may impact customer

satisfaction. To address this issue, an Android-based food ordering application is being developed using the waterfall method.

Babeh Sadeli Restaurant provides various fish menus. It is a fairly large area of approximately 500 m<sup>2</sup> which provides an indoor dining area with around 10 benches. And an outdoor area with bamboo gazebos around 20 gazebos. This restaurant can accommodate up to 100 visitors per day, and also a large parking area. From the results of the interview with the owner, the owner only needs 3 roles, namely waiters, kitchen, and cashier. There are 6 waiters, 3 kitchen staffs, 3 cashiers, and 2 admins. The system is only used internally and is not used publicly. Therefore, development is sufficient using waterfall.

The waterfall method is a sequential model of system development, consisting of phases such as requirements analysis, system design, implementation, testing, and verification. The waterfall model offers several advantages for Android application development, as demonstrated in recent studies. It provides a clear, structured approach with distinct phases, allowing for efficient development and easy project monitoring [1] [2]. This method has been successfully applied to various Android applications, including note-taking apps [3], e-archiving system [4], food sharing app [5], and educational tools [6]. The Waterfall model ensures thorough analysis of user requirements and system design before implementation, leading to applications that effectively meet user needs [1][3]. It also facilitates comprehensive testing, as seen in the e-archiving app achieving a 95% usability score [7]. Furthermore, the model's simplicity makes it suitable for small-scale projects and can be effectively combined with user-friendly development tools like MIT App Inventor [6].

Previous research on Android-based food ordering applications used the waterfall development method but was limited to implementing basic features such as ordering and transaction history [8]. Several previous studies have developed Android-based food ordering applications to improve restaurant operational efficiency. Similar research designed an application for K&Y Coffee using the Extreme Programming method, focusing on menu management and sales reports through an Android-based interface and website [9]. Meanwhile, a similar system for Dapur Sarjana, with an approach that emphasizes team collaboration and the use of Firebase as its database [10].

This study has a major difference, namely in the implementation of a system that integrates three roles (waiter, kitchen, and cashier) in a connected and real-time manner, both through mobile and web applications. The system designed not only facilitates ordering by customers, but also includes the internal operational processes of the kitchen and payment at the cashier in one centralized digital flow. This makes this study have a novel value in terms of system coverage and process integration compared to previous studies that were more focused on one side of the user. Thus, this study contributes to the development of a more comprehensive integrated ordering system to support the digitalization of small-medium scale restaurants.

The research question of this study is how to design a real-time food menu ordering system for mobile devices based on Android at Rumah Makan Babeh Sadeli?. The objective of this journal is to design a real-time food menu ordering system for mobile devices based on Android at Rumah Makan Khas Betawi Babeh Sadeli using the waterfall method.

## 2. METHOD

The waterfall method is one of the system development life cycles (SDLC) models, also known as the sequential linear model. The waterfall method provides a structured approach to software development that progresses sequentially through phases starting from analysis, design, coding, testing, and finally, maintenance[3][11][12]. The stages of system development using the waterfall model are as follows:

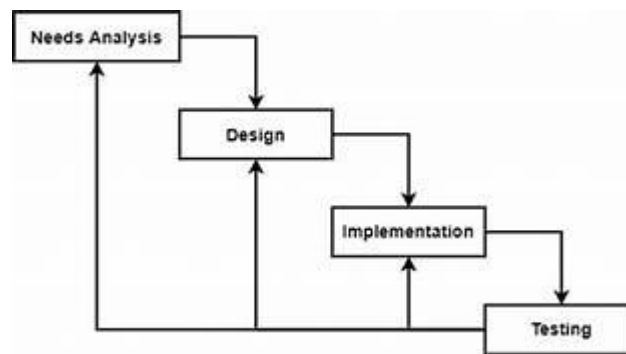


Figure 1. The Waterfall Method

The system analysis stage involves analyzing user needs by identifying problems related to the existing system and providing solutions based on the identified problems. During the analysis stage, developers focus on requirements gathering, defining system objectives and scope, and analyzing functional and non-functional needs [13][14]. In Problem Identification stage, the ordering process at Rumah Makan Babeh Sadeli is conducted manually, where waiters approach customer tables to take orders by writing them down, and then relay the information to the kitchen, which consumes considerable time and effort. In Problem Solving Stage, following the problem identification, a solution is proposed by developing an application that provides features to assist waiters in recording customer orders more efficiently, facilitates communication between waiters and the kitchen, and also connects the system to the cashier.

Design Stage involves the design of the system architecture to be developed. In this software design phase, Unified Modelling Language (UML) diagrams are created, including the design of the use case diagram and the activity diagram for the system. A use case diagram is an abstraction of the interaction between a system and its actors, describing the types of interactions that occur between users and the system [3][8][13]. The actors represented in the use case diagram include the admin, waiter, kitchen staff, and cashier. Data design is a detailed process aimed at describing the relationships between tables within a system.

The implementation phase in the waterfall model for Android app development involves several key activities. After completing the analysis and design stages, developers proceed to code the application based on the established requirements and specifications [3]. This phase includes creating user interfaces, implementing functionality, and integrating various components of the app [1]. The process typically involves building features such as data management, user authentication, and specific functionalities relevant to the app's purpose [3].

At testing stage, all modules that have been developed in the previous phases are integrated and tested to determine whether the system still contains any errors in its features or if it functions as expected [5][15][16]. At maintenance stage, maintenance is performed on the developed system to ensure that all features remain monitored and continue to function properly throughout the application's usage. In developing the ordering menu application in this study, the operating system software specifications were used Windows 10, framework flutter, Framework Laravel v7, Visual Studio Code dan Database MySQL.

Firebase Realtime Database uses WebSocket's to maintain a persistent two-way connection between the client and the server. Data changes (e.g., an order added by a waiter) are immediately "pushed" to all clients listening on that node (e.g., kitchen staff & cashiers).

### 3. RESULT AND DISCUSSION

In developing the ordering menu application in this study, the device specifications used were: The dashboard page for reporting orders is a page that contains several reports from stored transaction data. On this page, there is a Today's Income Report to display the calculation of today's total income based on transactions processed that day. The Total Menu Sold Report feature displays the total menu sold today based on transactions processed that day. The Total Menu Sold Report feature displays the total accumulation of menus sold for one month. The Total Income Report feature displays the total accumulation of income based on transactions processed for one month. The Total Order Report feature

displays the total order transactions that occurred in one month and is displayed in graphical form. The Last Order Report feature displays a list of the last ordered menus. The Most Frequently Ordered Menu Report feature displays the most frequently ordered menu data. The following page is a page for users of waiters, kitchen staff and cashiers of the operating system.

The real-time flow between roles starts when the waiter enters an order. The data is sent to Firebase on the "orders/" node. The "child added" event is immediately received by the kitchen staff. The kitchen staff sees the new list and clicks "process". Updates the status field "on progress". This event is also received by the cashier who listens for status changes. The cashier receives a notification that the order is "served" and enters the payment.

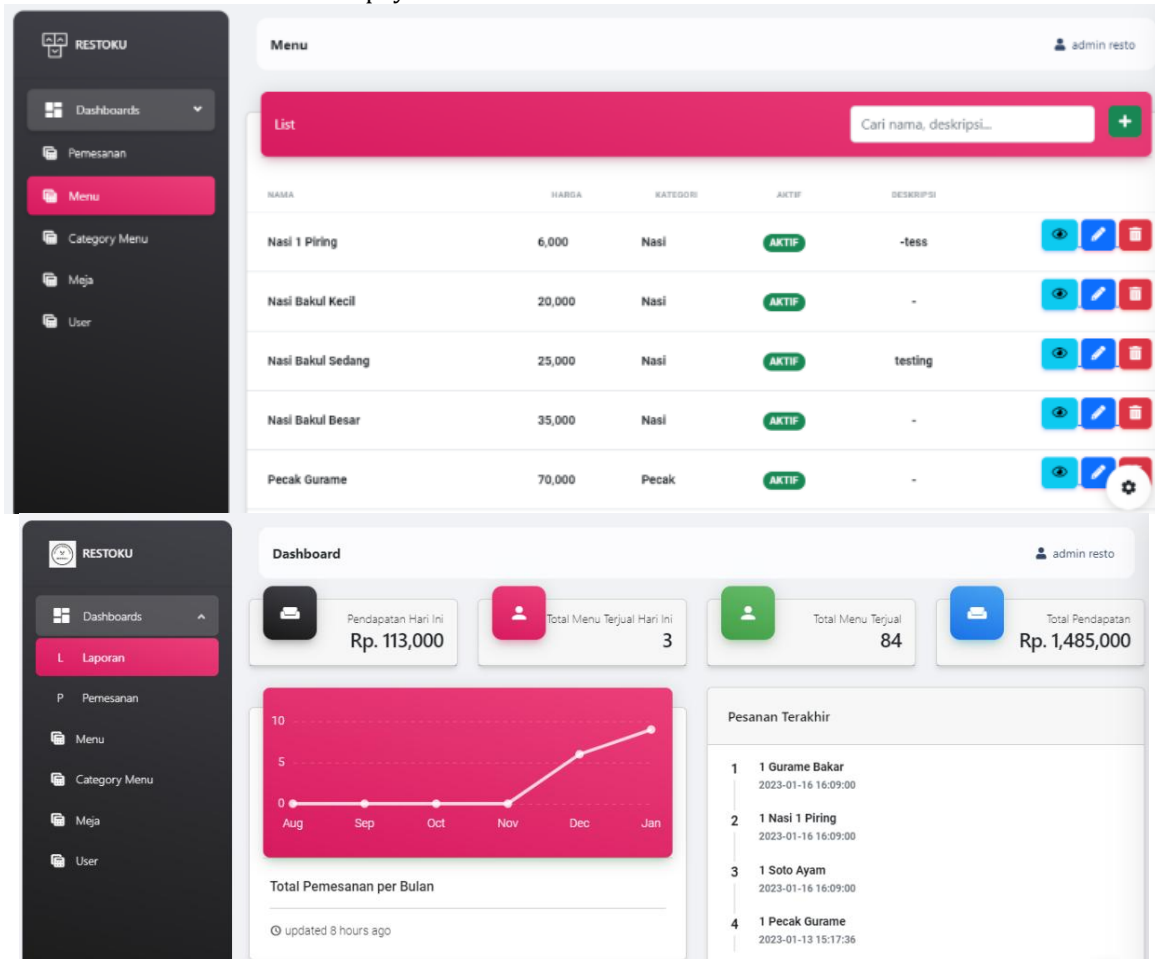


Figure 2. Dashboard Page

The order input page is the main page displayed when the server user logs in. This page displays a list of available menus. The add button feature is located below each menu data, functions to add a menu to be ordered. The minus button feature is located below each menu data, functions to reduce the menu to be ordered. The order button features functions to serve orders and enter order details after the user selects the menu data. The search feature functions to search for menus from the available menu list.

The order details page functions to view order details that have been previously inputted on the order input page. The Customer Name Textbox feature is used to record the name of the customer who placed the order. The table dropdown feature contains available table data and functions to select table data. The notes textbox feature functions to write notes if necessary. The order button features functions to place an order, then the order data will go to the kitchen user page.

The kitchen order list page contains a list of orders inputted by the waiter. Displays information in the form of table number, order status, and a detail button that functions to display the order details

page. The kitchen order details page is used to view menu details that must be prepared according to the order inputted by the waiter. There is a finish button that functions to complete the order when the order is complete and ready to be served. This cashier order detail page contains customer order details. This page functions to serve the customer payment process and to print payment notes for customers via the print button.

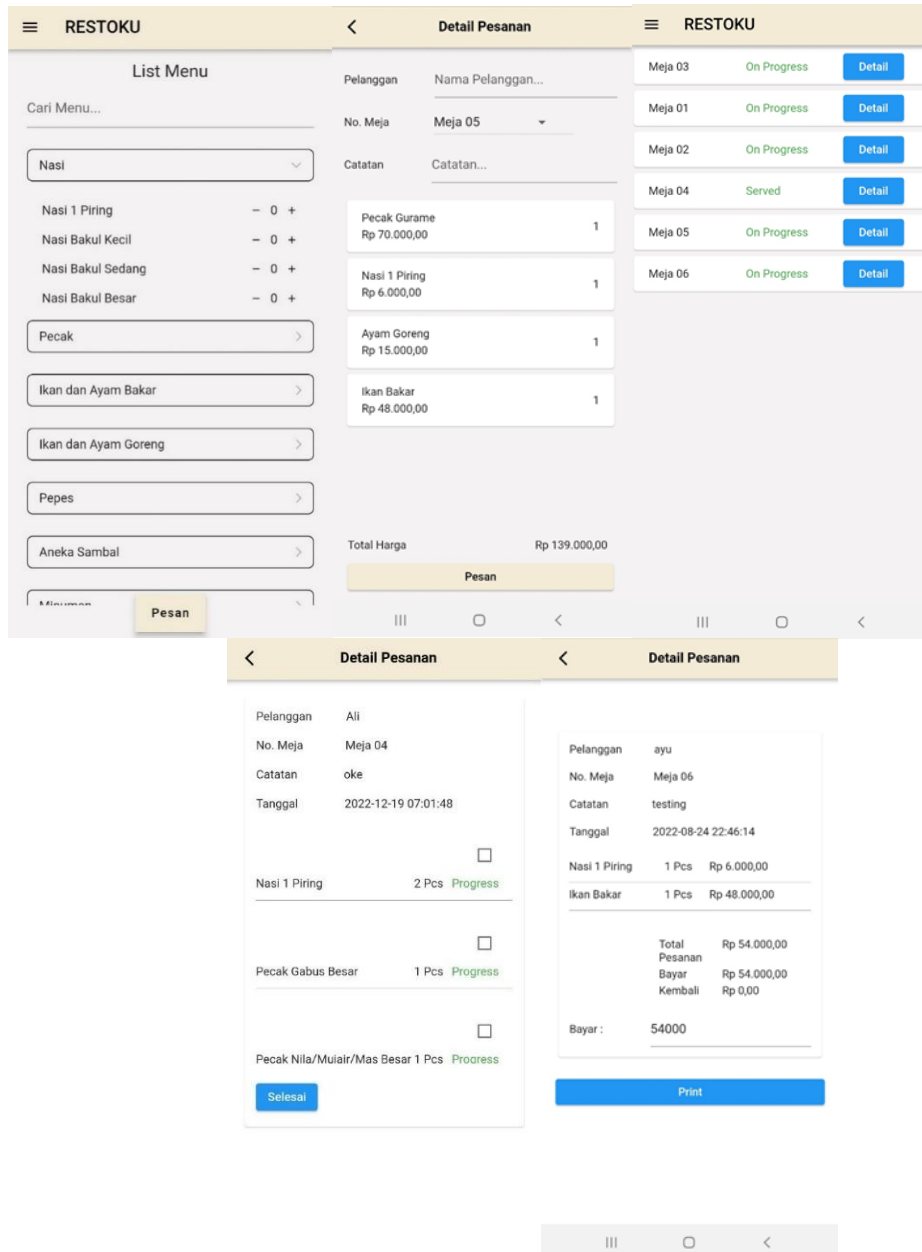


Figure 3. Order Page

The testing of this application is using the Blackbox method. The Blackbox testing method or often called functional testing is a software testing method to test software functionally without knowing the internal structure of the program code [5][17].

Table 1. Web Testing

Feature	Expected Result	Result
Login Admin	Can perform login process with admin user	Success
Dashboard Page	Can display transaction information such as total menu sold, total income, and monthly graphs	Success
Menu Page	Users can view menu data, can add, change, and delete menus	Success
Category Menu Page	Users can view menu category data, can add, change, and delete menu categories	Success
Table Page	Users can view table category data, can add, change, and delete tables	Success
User Page	Can view user data, can add, change, and delete users	Success

Table 2. Android Test

Features	Expected Result	Result
Login User	Can perform the login process with 3 user roles, namely waiter, kitchen, and cashier	Success
Order Input Page	Can display a list of menus and can input the number of menus to be ordered	Success
Order Detail Page	Users can see the details of the menu that has been inputted to re-confirm the order	Success
Order List Page Kitchen	Displays a list of orders that need to be processed by the kitchen	Success
Kitchen Order Detail Page	Users can see the details of what menus are ordered and can complete the order	It is success but do not receive notifications
Cashier Order List Page	Cashier users can see a list of transactions that need to be processed	Success

Based on the results of Blackbox testing of 12 main features in the system, it was found that 11 features (92%) functioned according to the specified specifications, while 1 feature (8%) experienced problems. The failed feature was related to notifications to the kitchen, which did not appear in real-time when the order was sent by the waiter. This was likely caused by a network connection or a misconfiguration of the Firebase Realtime Database. Although most features were running normally, problems with the notification system could hamper the operational process in the kitchen. For this reason, improvements need to be made to the data synchronization module and adjustments to the delay in sending data between devices.

The future improvement plan is to audit and correct the Firebase Configuration. If the connection fails when the waiter sends the order, it is necessary to display an error notification and do an automatic retry at a certain interval. Or use Firebase Analytics to detect delays, unsent messages, or listener errors in real-time. In addition, a special retest of Real-Time Sync using a different network is needed.

This study has several limitations that need to be considered. First, the system was only tested on a limited scale at one restaurant, so the validity of its use in a larger restaurant scenario or with a more complex operational flow cannot be ascertained. Second, testing was only carried out using the

Blackbox method without involving performance testing such as response speed, data security, or load testing. Using black-box testing alone is sufficient in the early stages because testing is focused on validating the main functions of internal applications, in the context of small-to-medium scale systems, with a limited number of users, and non-sensitive data. Performance and security testing can be performed in the advanced development phase, if the scope of the application becomes more complex or public. In addition, integration with digital payment systems and management reporting has not been implemented comprehensively.

#### 4. CONCLUSION

Based on the results of functional testing, it can be concluded that the development of a food menu ordering application uses the waterfall method with 4 sequential stages, namely the analysis, design, implementation and testing stage. Getting results that are in accordance with user needs. The results of testing with the Blackbox testing method carried out on each feature in the application, resulted in functional testing that can run properly by 92%.

For further research, it is recommended that the system be tested on several types of culinary businesses with different operational scales to test the scalability and flexibility of the system. In addition, system development can be improved by adding a sales analytics module, integration with a digital cashier system (POS), and security enhancements such as two-factor authentication. Further research may also consider the use of agile development methods to be more adaptive to changing user needs.

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