Implementation of the Flutter Framework for Developing an E-Commerce Application

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Abstract—The use of digital technology in the retail business has become imperative for competing in the modern era. For businesses such as vegetable shops, the presence of a digital platform is no longer an option but a critical necessity to remain relevant and competitive in an increasingly challenging market. Garvita Fresh Vegetable Shop still relies on conventional methods for vegetable ordering, typically conducted through platforms like Instagram or WhatsApp. In this context, there is a significant opportunity to enhance efficiency and customer experience by introducing a dedicated and well-integrated e-commerce platform. Therefore, the development of an e-commerce application using the Flutter framework for Garvita Fresh is essential. This application is developed using Visual Studio Code, the Flutter framework, and Firebase as the database. Data collection methods include observation, and the system development employs the waterfall model due to its clear, practical, and well-defined stages. System testing includes Black Box and Beta Testing, ensuring that the resulting application meets the expectations of prospective users.

Keywords—E-Commerce, Framework Flutter, Garvita Fresh, Mobile.

I. INTRODUCTION

The adoption of digital technology in retail business has become essential for competing in the modern era. For businesses like vegetable shops, having a digital platform is no longer optional but a critical necessity to stay relevant and competitive in an increasingly challenging market. In this regard, the development of a mobile application is a key strategy to increase market penetration, enhance customer service, and optimize operational processes (Kim & Kim, 1989a).

Garvita Fresh Vegetable Shop is a retail business focused on selling fresh vegetables online. Given the intense competition in the industry, the shop must continuously innovate to provide the best customer experience and improve operational efficiency. A mobile application can serve as an effective tool to achieve these goals.

Currently, Garvita Fresh Vegetable Shop relies on conventional methods for ordering vegetables, typically conducted through platforms like Instagram or WhatsApp. While social media has facilitated marketing and sales processes, these platforms still have limitations in order management, inventory tracking, and customer interaction. In this context, there is significant potential to improve efficiency and customer experience by introducing a dedicated and well-integrated e-commerce platform(Azizah Nur Rochmah et al., n.d.; Mclean et al., 2018).

In recent years, e-commerce has experienced rapid growth, changing the way businesses are run in various sectors, including retail. The use of digital platforms in buying and selling transactions has now become a necessity for many small and medium enterprises (SMEs) who want to remain competitive in an increasingly global market. The rapid development of digital technology has encouraged SMEs to adopt e-commerce solutions as an integral part of their business strategy.

Garvita Fresh, as one of the SMEs operating in the retail sector, faces challenges in keeping up with this flow of change. E-commerce is not just an additional option but has become an urgent need to maintain business sustainability. Many SMEs, including Garvita Fresh, are starting to turn to e-commerce platforms to expand their market reach, improve operational efficiency, and increase customer satisfaction through faster and more responsive service.

By adopting this approach, Garvita Fresh Vegetable Shop can leverage modern technology to expand market reach and enhance service quality, thereby increasing its competitiveness in an increasingly competitive market (Sagar, 2024).

Based on the problem description, this study will develop an e-commerce application using the Flutter framework for Garvita Fresh(Liang & Turban, 2011).

The development of this e-commerce application will help Garvita Fresh expand its market reach, reduce manual errors in order management, and provide convenience for customers in making online transactions. Features such as order notifications, product catalogs, and secure digital payment systems can be integrated to improve service quality. In addition, the application can also provide analytical data that is useful for understanding customer preferences and planning further business strategies.

With this solution, Garvita Fresh can compete more effectively in an increasingly digital and competitive market and increase customer loyalty through faster and more responsive services. The implementation of this Flutter-based e-commerce application will also provide the flexibility and scalability needed to support future business growth.

II. LITERATURE REVIEW

A. Application

According to (Kim & Kim, 1989b; Wilson & Fund, 1987), an application is a software developed by a computer company to perform specific tasks, such as Microsoft Word or Microsoft Excel. The term "application" is derived from "application," which refers to the practical use of a tool or system. (Abdurahman et al., 2014; Azis et al., 2020)defines an application as the process of storing certain data, issues, or tasks into a medium or tool that can address existing problems, transforming them into a new form while retaining the fundamental value of the original data.

B. Mobile

(Holzer & Ondrus, 2009; Islam et al., 2010) describe "mobile" as an adjective meaning capable of moving or being moved freely and easily. In this context, mobile can also refer to high-tech devices that operate without cables, such as smartphones, PDAs, and tablets. Additionally, "mobile" can denote motorized vehicles capable of movement. Furthermore, "mobile" can refer to a program that is widely accessible, easily reachable, and modifiable without significant difficulty (Hoehle & Venkatesh, 2015; Holzer & Ondrus, 2011).

C. Android

According to (Developers, 2011), Android is defined as "a Linux-based operating system used for smartphones and tablet devices (PDAs)." The open nature of the Android platform, which allows developers to create their own applications, has contributed to Android's popularity as a mobile operating system. Android is an open-source Linux operating system for mobile devices, as referenced from Wikipedia. The open and free nature of Android provides a platform for developers to create applications that can run on Android devices, enabling it to compete effectively in the market alongside earlier entrants like Blackberry and iPhone. (D. Android, 2011; Gilski & Stefanski, 2015) describes Android as "an operating system developed for Linux-based mobile devices." Initially developed by Android Inc., the operating system was acquired by Google in 2005.

D. Android Software Development Kit

According to (S. D. K. Android, 2012), the Android SDK (Software Development Kit) comprises the tools and APIs (Application Programming Interfaces) necessary for developing applications on the Android platform using the Java programming language. Android SDK includes a suite of software components for mobile devices, including the operating system, middleware, and essential applications released by Google. The Android SDK serves as a tool and API to facilitate the development of applications on the Android platform using Java, providing a neutral application platform that allows for the creation of necessary applications.

E. Framework

According to (Fayad & Schmidt, 1997)(Fayad & Schmidt, 1997), a framework is defined as a foundational conceptual structure used to solve or address complex problems. In essence, a framework serves as a scaffold or framework for building a website or mobile application. Utilizing such a framework streamlines the process of developing or maintaining an application, facilitating easier modifications. The use of a framework provides several advantages, including a well-organized structure for the program due to the availability of pre-built libraries or functions. Additionally, frameworks enhance collaborative programming efforts by ensuring that the system or application adheres to the framework's style. One commonly used framework is Laravel, a PHP-based, open-source framework that employs the model-view-controller (MVC) concept and is licensed under the MIT License, with its development hosted on GitHub.

F. Flutter

According to (Windmill, 2020), Flutter is a Software Development Kit (SDK) created by Google for developing mobile applications using the Dart programming language, applicable to both iOS and Android platforms. Flutter enables the construction of applications using a single programming language, Dart, whereas native applications for Android were previously developed using Java or Kotlin, and for iOS using Objective-C or Swift. Flutter aims to simplify and accelerate the mobile application development process, allowing applications to run on both Android and iOS without the need to learn two separate programming languages.

1. Flutter Architecture
   a. Widgets: All UI elements in Flutter are widgets. Flutter provides a variety of basic widgets such as buttons, text, images, and more that can be combined to build user interfaces.
   b. Rendering Engine: Flutter uses a rendering engine called Skia, which allows direct rendering to the canvas, avoiding dependence on native platform components.
   c. Dart Language: Dart is the programming language used by Flutter. Dart supports modern features such as asynchrony and hot reload.
2. Flutter Advantages
   a. Flutter enables the development of apps for multiple platforms from a single codebase, reducing development time and costs.
   b. Flutter provides high performance thanks to the Skia rendering engine and direct compilation to machine code, resulting in fast and responsive apps.
   c. The hot reload feature allows developers to see code changes instantly without having to restart the app. This increases productivity and speeds up the development cycle.
   d. Flutter enables consistent widgets across platforms, ensuring that apps look and function the same on Android, iOS, web, and desktop.
   e. Flutter provides full control over UI design and interactions, allowing developers to create highly customized and unique interfaces according to the needs of the app;
   f. Flutter has an active and growing community with many plugins and packages available, as well as official support from Google.
3. Flutter Disadvantages
   a. Apps developed with Flutter tend to have larger file sizes compared to native apps. This can be a problem for users with limited storage space.
   b. While Flutter supports many platforms, some platform-specific features may not be available out of the box and may require custom implementation.
   c. While the Flutter community is growing, it is possible that some libraries and plugins available for native platforms may not have been fully ported to Flutter, or may require additional development.
   d. Using the Dart language may increase the learning curve for developers who are not familiar with the language. While Dart is a modern and easy-to-learn language, it does take time and effort to adapt to;
   e. While Flutter has made strides in supporting web and desktop development, its functionality and stability may not be as robust as it is for mobile app development.

G. E-Commerce

According to (Raport & Jaworski, 2001), e-commerce refers to the activity of buying and selling goods or services over the internet, where buyers and sellers do not interact physically but communicate through online media. defines e-commerce as the process of buying and selling products electronically between consumers and businesses, using computers as intermediaries for business transactions. E-commerce encompasses all forms of transactions involving the sale and purchase of goods or services through electronic media.

H. Firebase

According to (Khawas & Shah, 2018), Firebase is a Backend as a Service (BaaS) platform owned by Google. Firebase offers a solution that simplifies the development of mobile applications by enabling developers to focus on application development rather than backend issues.

III. RESEARCH METHOD

According to (Pressman, 2018), the waterfall model is a classical model characterized by its systematic and sequential approach to software development. Officially known as the "Linear Sequential Model," this model is also referred to as the "classic life cycle" or the waterfall method. It is categorized as a generic model in software engineering and was first introduced by Winston Royce around 1970. Although often considered outdated, it remains one of the most widely used models in Software Engineering (SE). The waterfall model follows a systematic and sequential approach, with each stage requiring the completion of the previous stage before proceeding, hence the name "waterfall."

The Waterfall model is known as one of the most traditional and structured software development methods. The main reason behind its choice is the order and clarity it offers. In this model, the development process is divided into separate and linear stages, starting from requirements analysis, design, implementation, testing, and maintenance. Each stage must be fully completed before moving on to the next stage.

One of the major advantages of the Waterfall model is its ability to provide clear and comprehensive documentation at each stage. This is especially useful in projects where requirements are clear and do not change much, and when there is a need for detailed documentation. Comprehensive documentation helps the team and stakeholders have a common understanding of

what is being developed and makes tracking and planning easier.

This model is also suitable for projects with tight budgets and schedules, where frequent changes and additional iterations can add complexity and cost. Since Waterfall follows a structured flow, detailed planning and a tight schedule can be implemented more easily. This allows the team to determine and follow a more predictable budget and schedule. The waterfall flow can be seen in figure 2.
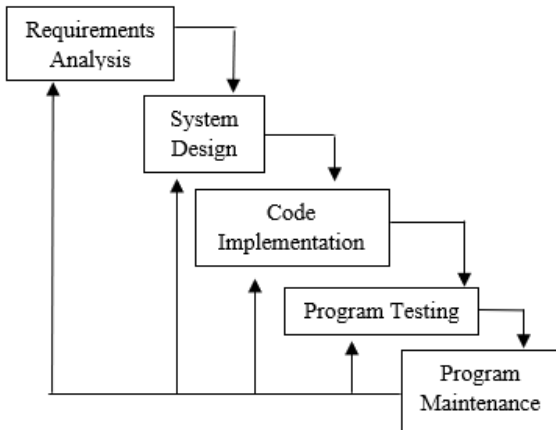

Figure 2. Waterfall model

The Waterfall method is a software development model that uses a gradual and structured approach. Each phase in this model is carried out sequentially, where one stage must be completed before the next stage begins. The development process starts from planning, needs analysis, system design, implementation (coding), testing, to system maintenance. The following is an explanation of each stage:

1. Requirements Analysis: At this stage, system requirements are collected and analyzed. The development team works with stakeholders to understand and document all functional and non-functional requirements.
2. System Design: After the needs are analyzed, the system design begins to be created. This design includes the system architecture, user interface, and data structure to be used.
3. Code Implementation: After the design is approved, the developer begins writing program code based on the specified specifications.
4. Program Testing: This stage aims to find and fix errors in the system. Each component is tested to ensure that they function according to the specified needs.
5. Program Maintenance: After the software is released, maintenance is carried out to fix bugs, make updates, or adjust to changing user needs.

IV. RESULTS AND DISCUSSIONS

A. System or Application Design

The design phase of the system or application aims to provide an overview of the design and flowchart.

1. Flowchart Login

In the flowchart, as illustrated in Figure 3, the admin or user will first perform a login by entering their email and password. The system will then verify whether the email and password are correct. If the credentials are correct, the user will be directed to the main page. If the credentials are incorrect, the user will be redirected back to the login page.
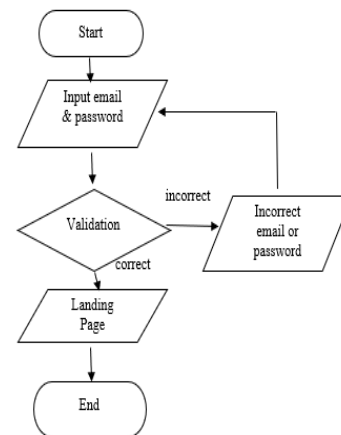

Figure 3. Flowchart Login Admin and Doctor

2. Flowchart administration user account

In the flowchart depicted in Figure 4, the user enters personal data to register an account. After the user completes the input of personal information, the application will validate whether the email has already been registered. If the email is not registered, the application will redirect the user to the main page. Conversely, if the email is already registered, the application will display a message indicating that the email is already in use.
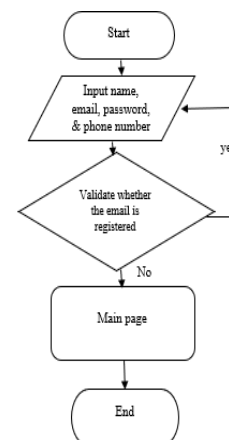

Figure 4. User list

3. User Transaction Flowchart

In Figure 5, the user initiates a transaction by selecting a product from the application and entering the quantity they wish to order. The application then validates whether the selected product is available. If the product is not available, the application will display a message indicating the unavailability of the product. If the product is available, the application will proceed to the cart page. On the cart page, the user is required to fill out an address form, including recipient details, recipient address, and recipient phone number. Once all information is provided, the user must choose a payment method available in the application. After completing all required data, the user can proceed with checkout or finalize the transaction process.
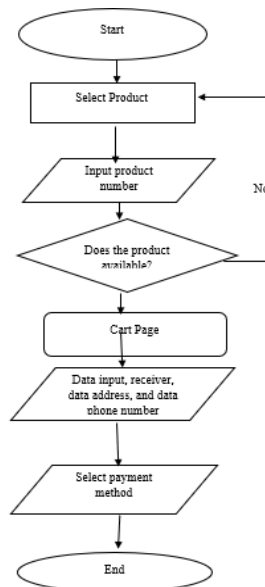

Figure 5. Flowchart user
Transaction

4. Admin Transaction Process Flowchart

In the flowchart depicted in Figure 6, the admin processes transactions through the transaction page. The admin selects the transaction to be processed. If the chosen transaction uses the transfer payment method, the admin can view the transfer proof on the transfer proof page. Once the user has submitted the transfer proof, the admin can proceed to complete the transaction if the product has been received by the user.
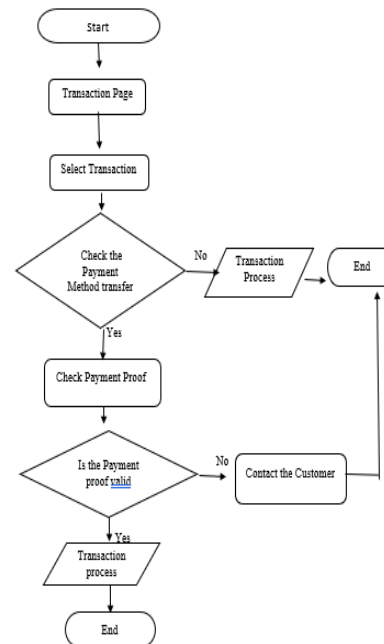

Figure 6. Admin Transaction
Process Flowchart

5. Sitemap

In the existing sitemap image, it is explained how the structure of the Garvita Fresh Mobile-Based E-Commerce Application is as follows:

1. The admin back-end page consists of a dashboard page, a category page, a Transaction page and a settings page.
2. The admin Dashboard page only displays data from today's sales and the best-selling product sales data.
3. The admin Category page displays product category data.
4. The admin Transaction page is a page for viewing transaction data, adding transactions and processing transactions.
5. The Admin Settings page is a page for logging out or exiting the application.
6. The Front-End User page consists of a shop page, a cart page, a transaction page and an account page.
7. The Shop User page is the main display page of the application page after logging in, where users can see the products in the application.
8. The Cart page is a page for viewing product data selected by the user and a page for making transactions.
9. The Transaction page is a page for viewing transaction data that has been made by the user. Users can also see the transaction status on this page.

The Account page is a page for editing user data or logging out of the application.
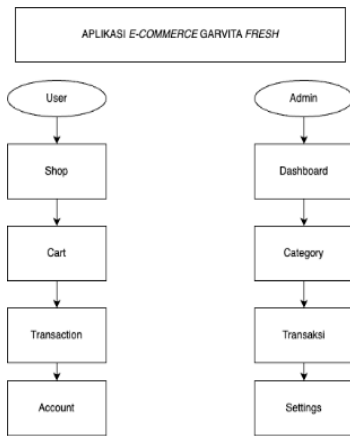
Figure 7. Sitemap Garvita Fresh Application

B. Implementation

The results of the implementation based on the analysis and design are as follows:

1. Visitor Login Page

Figure 8 illustrates the visitor login page, where visitors enter their email and password. The system then validates whether the email and password match and are registered within the application. If the credentials are correct, the application will display on the main page or homepage.
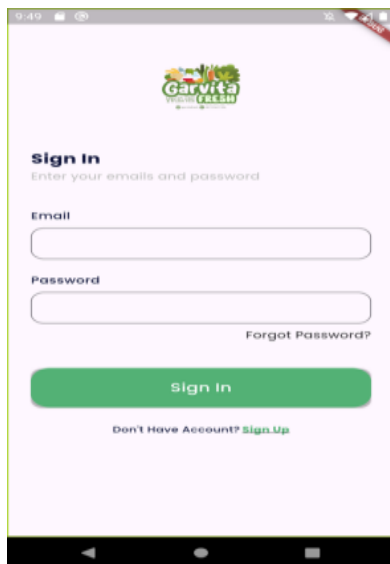

Figure 8. Visitor Login Page

2. Registration Page

Figure 9 depicts the registration page, where users must register if they do not already have an account. On this page, users are required to enter information such as full name, email, password, address, and phone number. After inputting the data and clicking the "Create Account"

button, the application will check whether the email has already been registered. If the email is already in use, the user will receive a notification indicating that the email is already taken. If the email is not registered, the application will return to the login page.

Figure 9. Registration Page

3. Main Application Page

Figure 10 illustrates the main page, or shop page, where users can view data on the products available in the Garvita Fresh application. Users can also view product details by clicking on the product card, which will direct them to the product detail menu. Additionally, users can add products to their shopping cart by clicking the "Plus" button on the product card, which will add the product data to the user's cart.
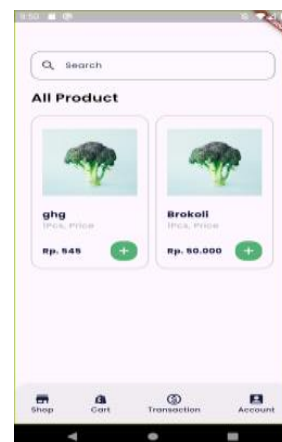

Figure 10. Main Application Page

4. Product Detail Page

Figure 11 depicts the product detail page. On this page, users can view detailed information about the product, such as its description and price. Users also have

the option to add the product to their shopping cart by entering the desired quantity and clicking the "Add to Cart" button. The application will then add the product data to the user's cart.

Figure 11. Product Detail Page

5. Cart Page

Figure 12 illustrates the cart page. On this page, users can view all items in their cart, including details of the products they have selected. Users can also adjust the quantity of each product by clicking the "Plus" or "Minus" buttons next to the product image. Additionally, users can proceed to checkout by clicking the "Go To Checkout" button, which will direct them to the transaction form to complete the purchase.

Figure 12. Cart Page

6. Transaction Page

Figure 13 depicts the transaction history page, where users can view the reservation data they have made. On this page, users can check the status of their payment to see whether it has been verified by the admin. If the payment has not been verified, the status will remain pending.

Figure 13. Transaction Page

7. Admin Dashboard Page

Figure 14 illustrates the admin dashboard page, where the admin can view transaction data for the current day as well as the most popular products sold through the application.

Figure 14. Admin Login Page

8. Category Page

Figure 15 depicts the admin category page, where the admin can view the available categories within the application. The admin also has the option to add new categories by clicking the "Plus" button located at the top right corner, which will direct them to the menu or form for adding category data. This category data will be used

to assign categories to each product. Additionally, the admin can delete or modify existing category data by clicking the corresponding buttons next to the category names on the category card.
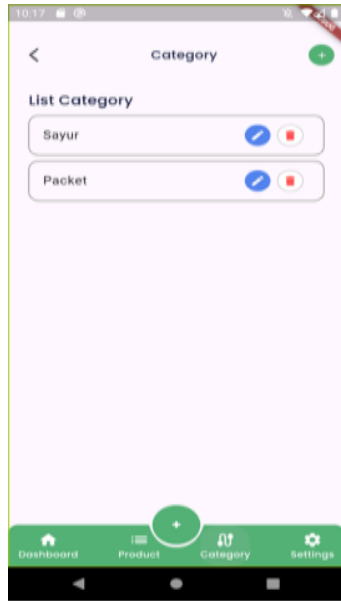

Figure 15. Category Page

9. Product Page

Figure 16 illustrates the product page, where the admin can view all registered product data within the application. The admin also has the capability to add new products by clicking the "Plus" button located at the top right corner, which directs them to the form for adding product data. Additionally, the admin can modify or delete existing product data by clicking the buttons next to the product names.
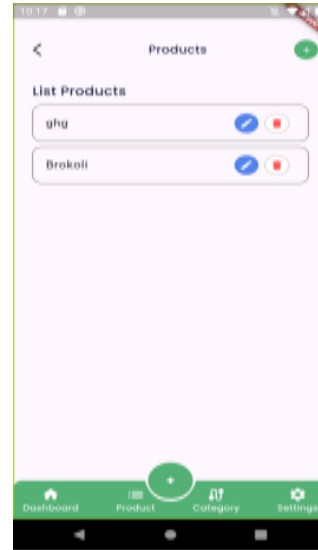

Figure 16. Product Page

10. Admin Transaction Page

Figure 17 illustrates the transaction page, where the admin can view all transaction data within the application. Here, the admin can also monitor the status of each transaction. By clicking on a transaction card, the admin can access the transaction details menu. Additionally, the admin has the option to add transaction data for customers who place orders outside of the application. This can be done by clicking the "Plus" button located at the top right corner, which will direct the admin to the form for adding transaction data.

Figure 17. Facility Page

V. CONCLUSION

Garvita Fresh mobile-based E-Commerce application has been successfully developed to simplify the reservation and transaction process for the public. This application is designed with a user-friendly interface, providing an efficient experience in ordering fresh products. Users can access complete information about Garvita Fresh products, including descriptions, prices, and availability. In addition, this application offers convenience in making payments and tracking orders.

With the development of the application on the Android platform, transactions have become more practical, considering the high use of smartphones among the public today. This application is also designed to support various payment methods, making it flexible for various types of users. In addition, the notification and real-time update features ensure that users always get the latest information about products and services. The development of this application is expected to increase the ease of access to Garvita Fresh services, supporting the increasingly digital lifestyle of the community.

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