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Design of Mobile Integrated Elf Car Transportation Information System with Waterfall Method

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ABSTRACT

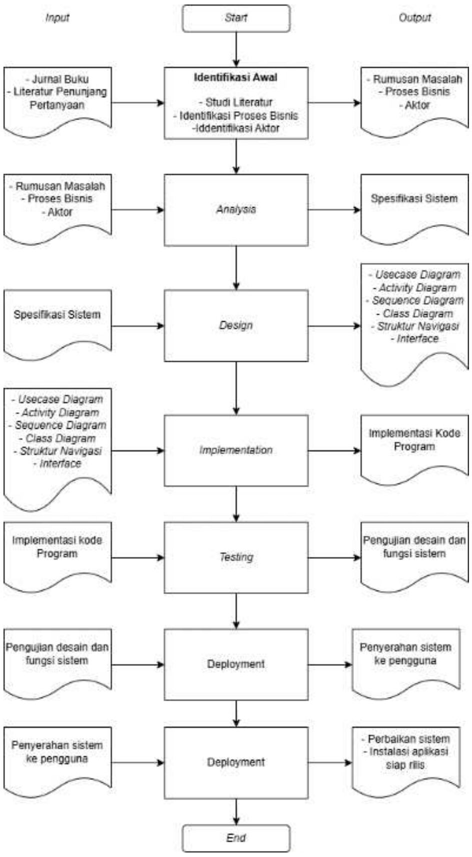
Elf is one of the leading transportation service providers in Garut, having earned a strong reputation for its superior reliability and punctuality. Known for its cheap fleet, Elf is the main choice of the people of Garut for daily travel and travel between villages and cities. To keep up with technological developments, Elf has integrated its services into a mobile platform, which allows people, including those in remote areas, to easily access information related to departure schedules. However, there are still significant challenges related to access to information, especially schedules, routes, and tariffs, which currently still rely on conventional methods that are often inaccurate. This research aims to design an Elf transportation information system that is integrated with a mobile platform using the waterfall method. This approach includes several stages, ranging from needs analysis, system design, implementation, to testing. The resulting system is expected to provide important features such as vehicle profile information, routes, travel schedules, and user feedback mechanisms. With this integrated information system, it is hoped that it can improve Elf's operational efficiency and provide a better experience for users. A user survey will be conducted at the bus terminal to gather feedback, in order to tailor the app's features to their needs. The implementation of this system is expected to be an effective solution to improve the quality of transportation services in Garut.

1. INTRODUCTION

Elf as one of the transportation service providers in Garut, has managed to gain significant popularity among the local community [1]. Known for its reliable quality and punctuality in its operations, Elf is popular with people living in remote areas as a means of public transportation. Elf car transportation integration with Mobile Platform has marked a significant evolution in modern transportation systems, offering more responsive solutions for remote communities [2]. With the increasing use of technology Mobile across all walks of life, transportation service providers like Elf are increasingly leveraging the advantages of this technology to improve accessibility on the go [3]. Through the app Mobile, users can easily information the departure schedule of Elf cars, speeding up the process and providing a smoother travel experience for customers. The real challenges faced by Elf transportation users, especially related to the lack of easy access to information on departure and arrival schedules, routes, and fares Online. Some previous studies regarding Mobile Integrated Elf Car Transport first research [4] created a website for public transportation routes in Garut Regency which is equipped with a map of public transportation routes so that it is easier for the general public to get public transportation information data. Then in the second study [5] The result is a website-based geographic information system for public transportation at the Mardika terminal in Ambon City that can provide data such as prices, schedules and public transportation routes for users and can make it easier for terminal managers to direct dynamic public transportation in Ambon City. After the design of the geographic data system, passengers can obtain data on movement routes and public transportation fares as well as public transportation data that can be accessed at the Mardika terminal. Next Third research [6] Produce an application that makes it easier for public transportation users to get data related to public transportation according to their needs. Where the system can provide detailed data regarding public transportation routes, schedules and fares. Public transportation applications can make it easier for public transportation users to find out the data and public transportation they need. Fourth research [7] Produce an app to make it easier for individuals to manage vehicle washing, administration, vehicle oil changes and motorcycle washing. Utilizing the Waterfall for the improvement of the application makes it easier to complete information collection, framework plans, implementation, testing and maintenance steps. The fifth research by [8] Producing a bus service information system through the use of innovations using the website, so that the data obtained by users is presented clearly and easily accessible, the impact will reduce the number of passengers who are left behind by the bus or the accumulation of passengers who do not get seats. Where the information or transaction data will be accessible through Copyright .Based on the description above, the author is interested in conducting a research with the title "Designing a Mobile Integrated Elf Car Transportation Information System with the Method Waterfall"The goal is to design and implement an integrated information system for the transportation of Elf cars related to the departure and arrival schedules of Elf cars in a systematic manner Online. So, the research will use software development methods Waterfall [9] [10], which provides a linear and sequential approach from the analysis, design, implementation, to testing stages. The system is designed to ensure good integration between Elf's car transportation services and the platform Mobile. So based on the background that has been explained above, the formulation of the problem from this research is obtained, namely: How to design an Elf car information system based on web apps with the waterfall method? How to implement the mobile integrated Elf car transportation information system to provide information according to the schedule listed in the terminal?

2. RESEARCH METHODOLOGY

The Waterfall model is a way of approach in building software that describes development methods in a straight and orderly manner. Where there are five to seven stages, each stage is marked with various efforts and targets, as well as the entire stage describes the product life cycle to delivery. When a stage is completed, the next step of development will follow and the consequences of the previous stage extend to the next stage. A frame of thought is usually a diagram that can provide an overview of the logical flow of a research. Picture 1 is the framework of the system research that was created.

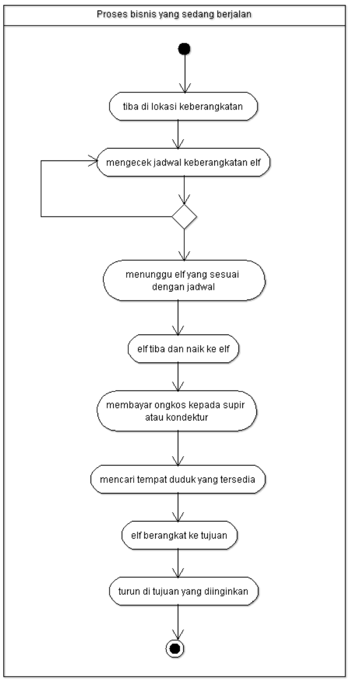


Picture 1. Research Framework

3. RESULTS AND DISCUSSION

3.1 Early Identification

For a description of business processes, it can be seen in Picture 2.


Proses bisnis yang sedang berjalan
tiba di lokasi keberangkatan
mengecek jadwal keberangkatan elf
menunggu elf yang sesuai dengan jadwal
elf tiba dan naik ke elf
membayar ongkos kepada supir atau kondektur
mencari tempat duduk yang tersedia
elf berangkat ke tujuan
turun di tujuan yang diinginkan

Picture 2. Ongoing Business Processes

The disadvantages of the Manual ELF Ascending Business Process are as follows.

1) Schedule uncertainty: passengers have to manually check schedules, which are often inaccurate, leading to uncertainty and delays.
2) Inefficient payments: manual payments to drivers or conductors are time-consuming and prone to errors.
3) Information limitations: passengers do not have access to real-time information about seat availability, routes, or schedule changes.
4) Lack of tracking and security: passengers can't track Elf in real-time or report issues easily.

To overcome this weakness, the mobile-based Elf transportation information system was designed. The app will provide real-time information on Elf's departure schedule and position, reducing uncertainty for passengers. In addition, passengers can check travel routes and ticket prices online through the app, making the process faster and more accurate.

3.2 Analysis

1) Identify the Actor

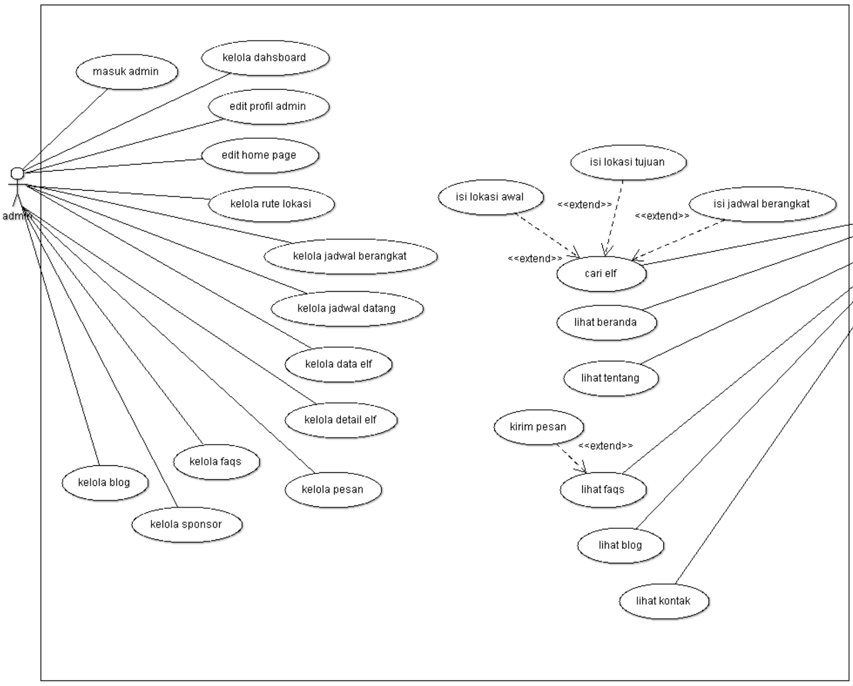
The activity of actors can be seen in table 1. as follows.

Table 1. Actors in the System

No.	Actor	Activity
1.	Admin	People who manage the system are admin login, manage dashboards, edit admin profiles, edit home pages, manage location routes, manage departure schedules, manage arrival schedules, manage Elf data, manage Elf details, manage messages, manage FAQs, manage sponsorships, and manage blogs.
2.	Community	People who can see schedules, price estimates, drivers, Elf photos i.e. search for Elf, fill in the starting location, fill in the destination location, fill in the departure schedule, view the homepage, view about, view FAQs, send messages, view blogs, and view contacts.

Table 1 presents the actors in the system and their activities. Admins are in charge of managing the system, including access to the dashboard, profile editing, homepage management, location routes, departure and arrival schedules, as well as Elf car data and blog content. Meanwhile, the community acts as a user who can access information such as schedules, price estimates, and photos of Elf cars. The public can also search for Elf cars, fill in the starting and destination locations, and send messages and access FAQs.

2) Designing a Use Case Diagram



Picture 3. Use Case Diagram

In Picture 3. The use case above contains 2 actors with each actor having 13 admin use cases and 10 community use cases.

3) Specifying System Specifications

This stage involves defining and documenting system specifications that include both functional and non-functional needs.

a) Functional Needs

This system provides features such as admins can manage dashboards, edit admin profiles, edit home pages, manage location routes, manage departure schedules, manage arrival schedules, manage Elf data, manage Elf details, manage messages, manage FAQs, manage sponsorships, and manage blogs. While people can search for Elves, fill in the initial location, fill in the destination location, fill in the departure schedule, view the homepage, view about, view FAQs, send messages, view blogs, and view contacts.

b) Non-Functional Needs

Minimum hardware requirements for developers, which include:

1. Minimum Intel Core i3 processor or equivalent of 4 cores or more.
2. A minimum of 4GB of RAM is recommended 8GB.
3. 10GB of free storage space for Laravel installations and its dependencies, SSDs are recommended for maximum performance.

Minimum software requirements for developers, which include:

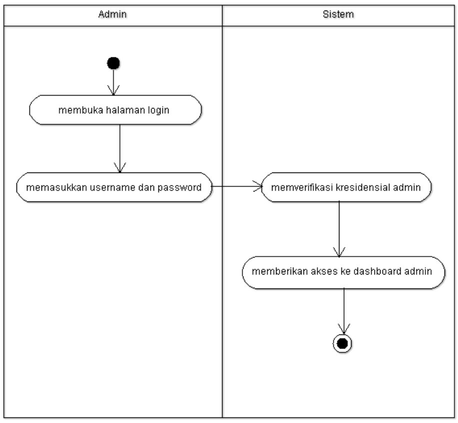
1. Windows 10 or later.
2. Mac OS 10.15. or the latest version.
3. PHP 8.0 or later.
4. Composer (PHP dependency manager).
5. Web servers such as Apache or NginX.
6. Server databases such as MySQL, Laragon, and Sqite.
7. Visual Studio Code.
8. Bootstrap version 3 and Tailwind.
9. Internet browsers such as Google Chrome, Microsoft Edge, and Mozilla Firefox.

Minimum hardware requirements for users, including:

1. Quad-core processor (1GHz) or better.
2. A minimum of 2GB or 4GB of RAM is recommended to support maximum performance.
3. Enough storage space for the app and data (for this app 100MB is enough) to access the internet.

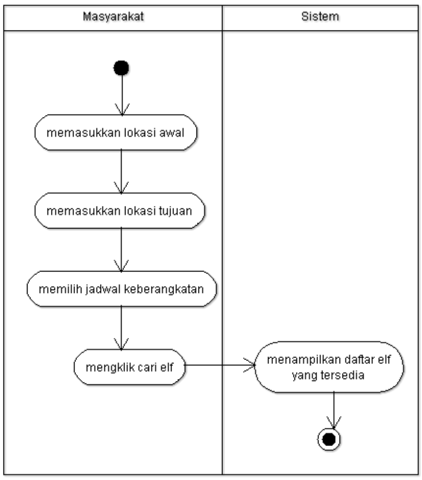
Minimum software requirements for users, including Android 7.10 Nougat or later.

4) Designing an Activity Diagram


Admin
Sistem
membuka halaman login
memasukkan username dan password
memverifikasi kresidensial admin
memberikan akses ke dashboard admin

Picture 4. Activity Diagram Login Admin

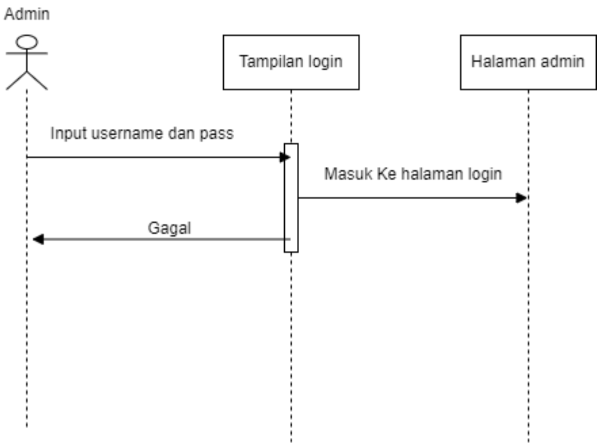
In Picture 4, the activity diagram design functions to describe the processes and workflows in the system systematically. This diagram helps in visualizing the steps involved in an activity, making it easier to understand the mechanisms that occur.



Picture 5. Activity Diagram Find Elf

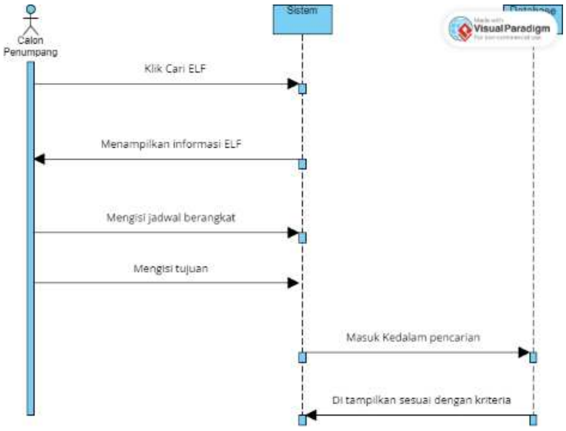
Using activity diagrams, the various interactions and decisions taken in the process can be clearly illustrated. It also allows the identification of potential issues or bottlenecks in the workflow. Overall, activity diagrams are an effective tool for designing and analyzing processes in complex systems.

5) Designing a Sequence Diagram



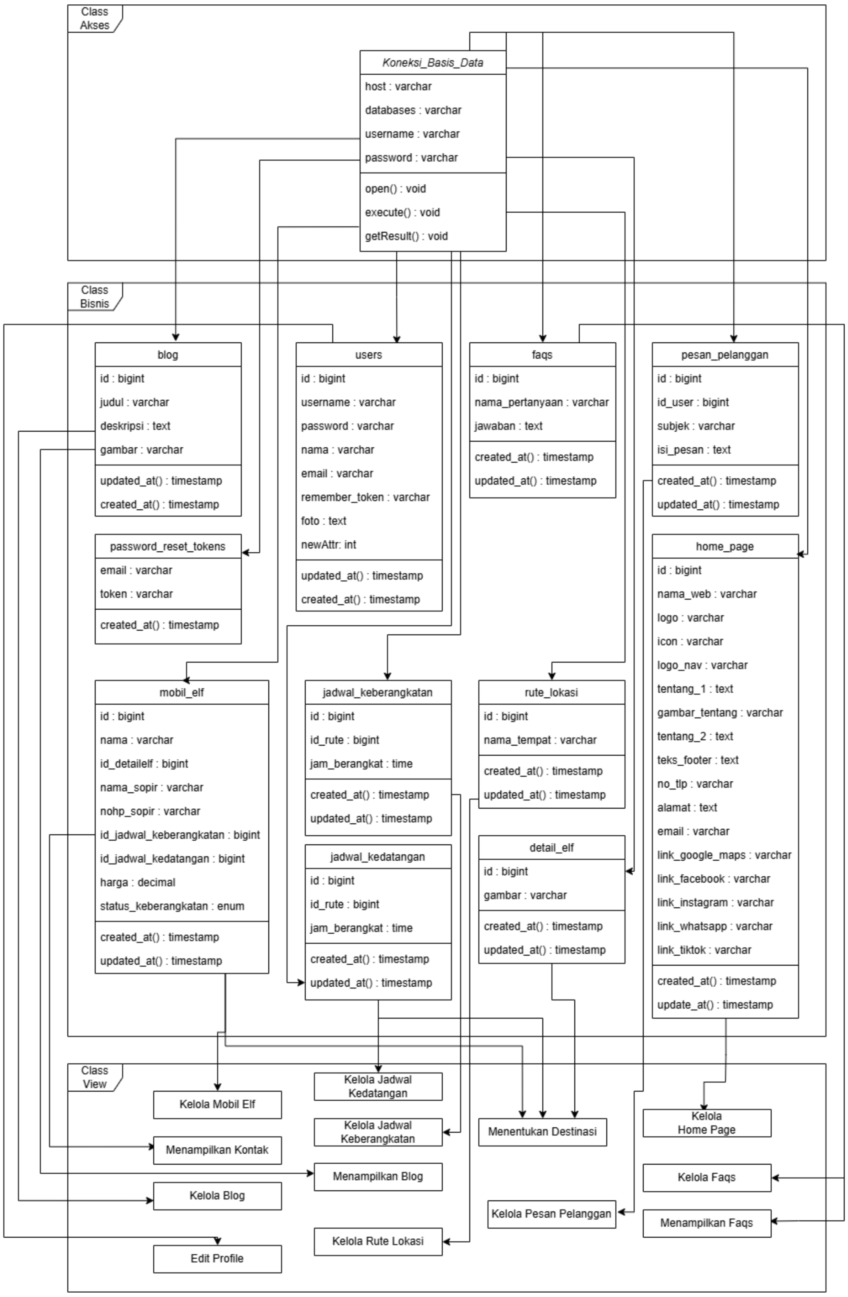
Picture 6. Sequence Diagram Login Admin

In Picture 6 a sequence diagram is used in software modeling to illustrate the sequence of messages sent between objects in the system. This diagram visually shows how objects interact with each other in a given scenario or case.



Picture 7. Sequence Diagram Find Elf

6) Designing Diagram Class



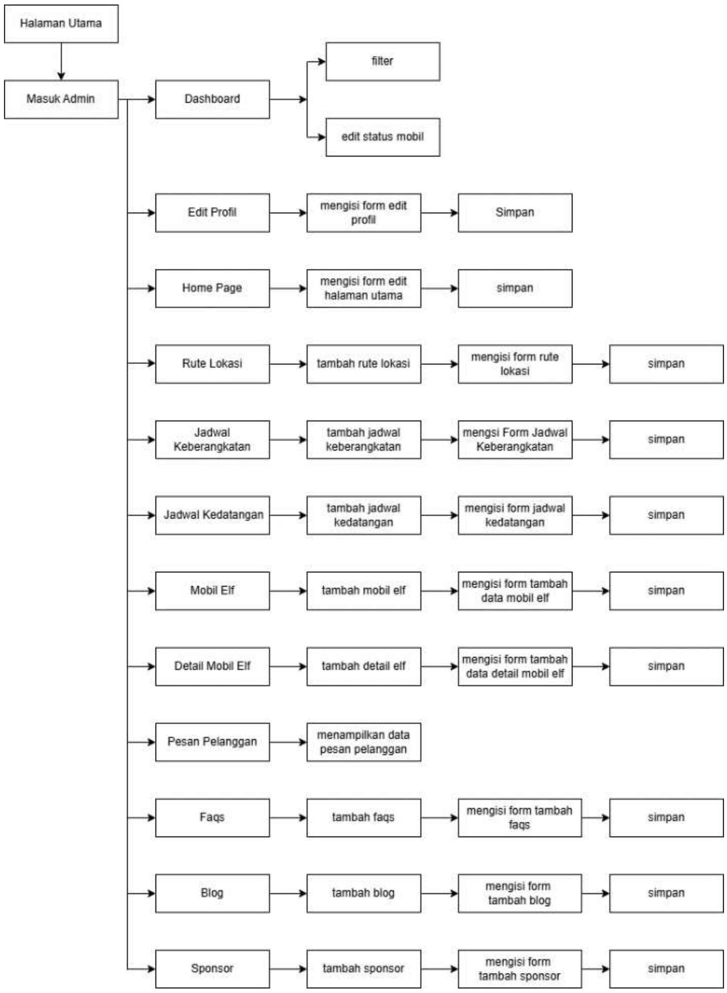
Picture 8. System Diagram Class

In Picture 8. class diagrams in the Elf transport information system, which includes several classes with specific functions. The mobil_Elf class stores car information, while home_page manage the content of the website's main page. The users class stores user data, and pesanan_pelanggan manage order information from customers. The jadwal_keberangkatan and jadwal_kedatangan classes are responsible for the departure and arrival schedules of the Elf cars, respectively. In addition, the database connection class manages the connection to the database, including host, database name, username, and password.

3.3 Design

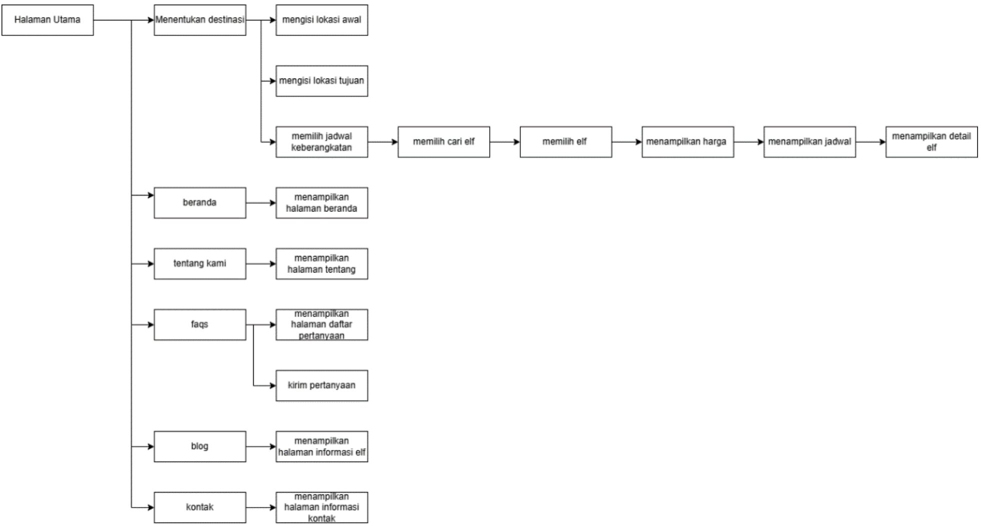
1) Designing a Navigation Structure

The structure of the admin navigation can be seen in Picture 9. as follows.



Picture 9. Admin Navigation Structure

Designing a navigation structure for an app focuses on setting how users move between different parts and features available in the system. Good navigation will ensure that users can easily find the information they need without any difficulty. Therefore, it is important to consider the hierarchy and order of the menus, so that the user experience becomes more intuitive. In addition, the navigation structure should also be responsive, allowing for smooth access across multiple devices. By designing efficient navigation, it is hoped that users can enjoy better interaction with the app and improve their overall satisfaction.



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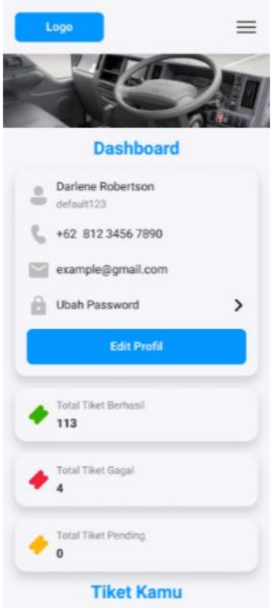
Picture 10. Community Navigation Structure

2) Designing the Interface

At this stage, the user interface (UI) for the application is designed.

a) Dashboard Page Interface



Darlene Robertson
default123

+62 812 3456 7890

example@gmail.com

Total Tiket Berhasil
113

Total Tiket Gagal
4

Total Tiket Pending
0

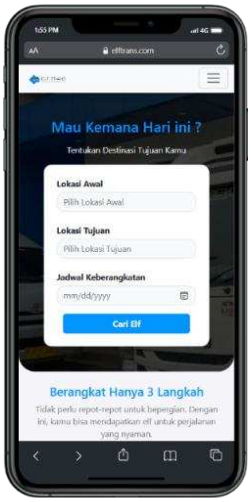
Picture 11. Dashboard Page Interface

In Picture 11. The dashboard page interface design displays a page for admins or users to enter the initial view of the application.

3.4 Implementation

The program code implementation stage is the phase in which the design of the system that has been designed is translated into executable source code.

1) Home View



Lokasi Awal
Pilih Lokasi Awal

Lokasi Tujuan
Pilih Lokasi Tujuan

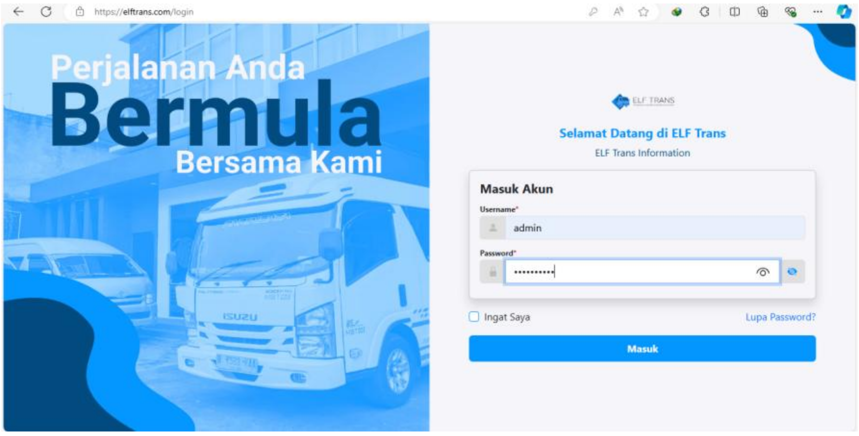
Jadwal Keberangkatan
mm/dd/yyyy

Tidak perlu repot-repot untuk bepergian. Dengan ini, kamu bisa mendapatkan elf untuk perjalanan yang nyaman.

Picture 12. Dashboard View

In Picture 13. The dashboard display above displays a page for admins or users to log in to the initial view of the application.

2) Admin Login View



Username*: admin

Password*: ••••••••••

Picture 13. Admin Login View

In Picture 14. The Admin sign-in view above displays a page for admins to sign in to the account.

3.5 Testing

The testing stage is the phase in system development, where the system that has been developed is tested to ensure that it works according to specifications and meets the needs of the user. Testing with the blackbox testing technique is a system test tested in terms of its function only. Explanation of system testing with several test activities that represent the entire system is described in Table 2.

Table 2. Blackbox Testing Results

Use Case	Test Scenarios	Test Data	Test Steps	Expected Results
Admin Login	Test the admin login process with the correct credentials.	Username and Password	1. Go to the login page. 2. Enter the correct username and password.3. Click the "Login" button.	The admin successfully logged in and was redirected to the dashboard.
View Home	Tests the user's ability to view the home page.	There is no specific test data.	1. Open the app.2. Click on the "View Home" option.	The home page is successfully displayed with the appropriate information.
Send a Message	Testing the user's ability to send messages through the app.	Name, Email, Message	1. Open the app.2. Click on the "Send Message" option.3. Fill in your name, email, and message.4. Click on the "Submit" button.	The message was successfully sent and the message was sent notification.

3.6 Deployment

The system handover stage is the final phase in system development, where the system that has been tested and declared ready for use is handed over to the end user. By distributing the application link that has been published to the public.

1) Server Setup: Set up a server that will be used for hosting applications, be it a cloud server (AWS, GCP, Azure) or a physical server.

2) Installation of OS and supporting software: Installation of operating systems (Linux or Windows), and supporting software such as web servers (Apache, NginX), databases (MySQL, PostgreSQL), and runtime environments (Java, PHP, Node.js, etc.).
3) Database Setup : Implement the database design on the selected database management system, and perform data migration if needed.
4) Database Connection Testing: Ensure that the application can connect with the database and perform CRUD (Create, Read, Update, Delete) operations correctly

3.7 Maintenance

The Release Ready Application Stage marks the completion of the entire system development and testing process, and prepares for rollout to end users.

1) Data Backups: Schedule regular backups for important databases and files. Backups can be done daily, weekly, or monthly depending on the need.
2) Test Restore: Periodically, test the data recovery capabilities of the backup to ensure that the backup can be used in an emergency situation.
3) Offsite Backup: Consider storing backups in a separate location (offsite) or in the cloud for better protection against physical disasters.
4) Security Updates: Release security patches as soon as there are updates or new vulnerabilities discovered, including updates to the software and libraries in use.
5) Feature Upgrades: Based on feedback from users, add or upgrade features. This may involve new developments, user interface (UI/UX) changes, or performance optimization.
6) Technology Migration: When the technology used becomes obsolete or no longer supported, plan for a migration to a new technology that is safer and more efficient.
7) Documentation Updates: Make sure that technical and user documentation is always updated with any changes made to the system.
8) Performance Evaluation: Conduct a system performance evaluation to identify areas for improvement.

3.8 Discussion

The answers to the research from the results of the questions in the introductory chapter are:

1) Designing an Elf car information system based on web apps with the waterfall method involves structured steps that begin with a needs analysis to determine the features and functionality of the system. After that, the system design and interface are developed, followed by the implementation of the code according to the design that has been set. Testing is performed to ensure the system is functioning properly, before entering the maintenance phase to address issues and perform updates.
2) Meanwhile, implementing the mobile integrated ELF car transportation information system requires the design of an application that can retrieve and display schedule and route data in real-time through an API connected to the backend system. This process includes integration of mobile apps with backends and testing to ensure the accuracy of information and app performance across multiple devices.

The alignment of research results regarding transportation information systems shows significant alignment with previous research, each focusing on the development and implementation of technology to improve transportation services. Research by Supriatna et al. (2022) and Rahmawati et al. (2022) shows that website-based systems are very effective in presenting transportation information such as routes, schedules, and prices to the public, making it easier to access without having to visit the terminal. Research by Falderika et al. (2021) emphasizes the importance of Android-based applications to make it easier to find information about public transportation, supporting the finding that mobile platforms expand the accessibility of transportation services. In addition, research by Fernando et al. (2023) and Dendi Rachmatsyah et al. (2021) shows that the use of waterfall methods and Rapid Application Development (RAD) in the development of Android- and web-based applications can produce more effective systems in transportation management and services. This alignment emphasizes that various methods and platforms for developing information systems can contribute to improving the efficiency and quality of transportation services, as well as ease of access for users.

4. CONCLUSION

The integration of the Elf transportation information system with the mobile platform through the waterfall method is a strategic step to improve the quality of transportation services in Garut. With this system, people's access to important information such as schedules, routes, and fares can be significantly improved, especially for those in remote areas. The implementation of this structured and comprehensive system is expected to not only improve Elf's operational efficiency but also provide a better user experience. Surveys and feedback from users will be the basis for the improvement of the app's features, ensuring that the developed system is able to meet the needs of users effectively and sustainably. In the end, this information system is expected to be an effective solution in facing existing challenges, as well as increasing customer satisfaction and the competitiveness of Elf's transportation services in Garut. Elf not only provides information regarding schedules, routes, and fares, but also comes with additional relevant features. The online payment feature can make it easier for users to make transactions quickly and safely. The seat booking feature allows passengers to reserve seats as they wish, making the journey more comfortable. In addition, the addition of a unit booking feature for wholesale rentals will open up opportunities for groups or groups that need exclusive transportation services. The GPS tracking feature is also very important to provide real-time information about the vehicle's location, so that users can find out the estimated time of arrival more accurately. The implementation of these features will provide added value

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