ISSN 3032-3533
Vol 2, No.1 (2025)

Design of a Web-Based Car Rental Information System Using the Waterfall Method

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***Abstract* — The rapid development of information technology has encouraged many business sectors to adapt and utilize technology to improve operational efficiency, including in the car rental industry. This research aims to design and build a web-based car rental management information system that is able to help business processes such as vehicle data collection, customer management, bookings, and transaction reporting in a structured and integrated manner. The system development method used is the Waterfall method, which consists of the stages of needs analysis, system design, implementation, testing, and maintenance. The result of this research is a web-based information system that can be used by admins and users efficiently to carry out the car rental process, as well as produce accurate and real-time reports. With this system, it is hoped that data management will be easier, service to customers will be more optimal, and the decision-making process by the management will be more precise based on the available data. This system also supports the digitization of services, so that it can increase the competitiveness of the car rental business in the current technological era.**

Keywords: Information Systems, Car Rental, Web, Waterfall, Transaction Management.

I. INTRODUCTION

With the development of increasingly advanced information technology, especially the internet, there is a great opportunity to overcome these various operational obstacles through the implementation of a web-based management information system. This system will allow car rental companies in the city of Medan to manage transactions, promotions, and administration more efficiently and effectively. The use of the web as the main platform provides easy access for customers to make orders, check car availability, and get other information anytime and from anywhere. The Waterfall method was chosen as an approach in the development of this system because of its structured and sequential nature. This method allows each stage of development to be carried out systematically from needs analysis, design, implementation, testing, to maintenance. By using the Waterfall method, it is hoped that system development can be carried out with careful and regular planning, so as to produce a system that suits the needs of users and is reliable

The implementation of a web-based car rental management information system in the city of Medan is expected to provide various significant benefits. This system will not only improve the operational efficiency of car rental companies, but will also expand the range of promotions and simplify administrative management. Customers will find it easier to find and order the cars they need, while companies can manage fleets and transactions more effectively. Thus, car rental companies in the city of Medan can compete better and develop in this digital era.[1]

By using this web application, admins can manage digital archive data so that service activities for archives are carried out properly. Based on the background that has been explained, the author hereby takes the title: "Design and Build a Web-Based Car Rental Management Information System with the Waterfall Method".

II. LITERATURE REVIEW

a. Rental or rental is an agreement or agreement in which the lessee is obliged to provide certain rewards or benefits to the owner of the goods for the use of the goods within an agreed period of time. In law, the practice of renting in the rule of law is allowed. Examples of rent-rental activities in daily life include: office building contracts, land leases for agriculture, vehicle rental or charter, original VCD/DVD rentals, and others.[2]
b. In general, a booking is an agreement between two or more parties to rent or book a place, room, facility, or service at a specific time. These orders occur before the actual purchase or transaction is made. The definition of booking according to (Khamil Aryansyah et al.2020), Booking is an agreement to order services or products offered by the company before purchase by consumers. According to [3], Booking is an agreement to order services or products that a company offers before closing with a purchase.
c. The word "system" is often used in a variety of contexts. The system is made up of components, each of which performs a unique function that complements the other. Each of its components forms a 'connection' that allows them to operate simultaneously during a given operation. This ensures

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that a goal can be achieved as intended. If one component does not function correctly, it will have a detrimental effect on the entire system. [4]. The system comes from the Greek Sustema or Latin Systema. Meanwhile, in terms of etymological vocabulary, a system is everything that is composed of many components that operate together to complete a certain task. Thus, each system will consist of many components. No system will exist on the basis of just one component. [5].

d. Information is the result of data processing so that it becomes an important form for the recipient and has a use as a basis for decision-making that can be felt directly immediately or indirectly in the future [6]. To obtain information, it is necessary to have data to be processed and processing units [7].
e. Information can be encoded into various forms for transmission and interpretation (for example, information can be encoded into a sequence of signs, or transmitted through signals). It can also be encrypted for secure storage and communication. The uncertainty of an event is measured by the probability of its occurrence and is inversely proportional to it. The more uncertain an event is, the more information is needed to resolve the uncertainty of the event. Beets are typical units of information, but other units such as grout can be used. For example, the information encoded in one "fair" coin flip is log2 (2/1) = 1 bit, and in two fair coin flips is log2 (4/1) = 2 bits. The concept of information has different meanings in different contexts. Thus the concept becomes related to the notion of constraints, communication, control, data, form, education, knowledge, meaning, understanding, mental stimuli, patterns, perceptions, representations, and entropy.
f. Information systems are formal, sociotechnical, organizational systems designed to collect, process, store, and distribute information. In a sociotechnical perspective, information systems are made up of four components: tasks, people, structures (or roles), and technology. A computer information system is a system that consists of people and computers that process or interpret information. The term is also sometimes used in a more limited sense to refer only to software used to run computerized databases or to refer only to computer systems. Information Systems is the study of academic systems with specific reference to information and complementary networks of hardware and software that people and organizations use to collect, filter, process, create and also distribute data. Emphasis is placed on information systems that have definitive boundaries, users, processors, storage, inputs, outputs and communication networks mentioned above [8]. Alter argues for the advantage of seeing information systems as a special type of work system. A work system is a system in which humans or machines perform processes and activities using resources to produce a specific product or service for customers. Information systems are working systems whose activities are devoted to capturing, transmitting, storing, retrieving, manipulating and displaying information. Thus, information systems are interconnected with data systems on the one hand and activity systems on the other. Information systems are a form of communication system in which data is represented and processed as a form of social memory. Information systems can also be thought of as a semi-formal language that supports human decision-making and action. Information systems is the primary focus of study for organizational informatics [10].
g. Waterfall or Software Development Life Cycle (SDLC) is a process that describes methods and strategies for developing, designing, and maintaining software projects. The main goal of SDLC is to ensure that all goals, objectives, functionality, and needs of users can be met effectively and efficiently [11].

Gambar 1. Waterfall

III. Research Methodology

In carrying out this research, several stages are carried out, the stages of this research are as follows:

3.1 Research Stages

Research in building a web-based car rental management information system has several stages:

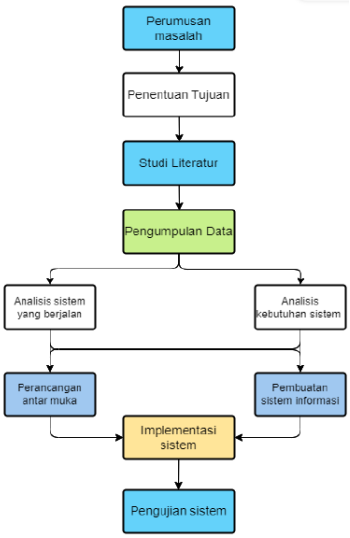

Figure 2. Research Stages

The research stages are arranged so that research and research results make the right contribution. This is so that there are no mistakes in carrying out the research [12]. The following steps are the procedures taken in conducting this research:

a. The formulation of the problem is determined as a determinant of the problem to be solved using an information system.
b. Determination of goals is the activity and direction of the research conducted.
c. Literature study is a search for references related to information systems. The feasibility of the study was

obtained from journals, the internet and books related to the method used.

d. Data collection is carried out by obtaining data used in a web-based car rental management information system.
e. Analysis is carried out to determine the technique of solving a problem formulation and compare with the method. Design and build a web-based car rental management information system using the WaterFal method.
f. The design of the system aims to determine the model used in the creation of a website.
g. Website creation aims to create a system that can communicate with users in real time.
h. The discussion serves to review the results that have been produced. The discussion was carried out to provide synchronization.
i. System Testing is a website test that has been created using the PHP programming language to determine the advantages and disadvantages of the system.

3.2 Data Collection Methods

Data is an object that is processed in an information system. This data is very important in providing the results of information system processing. The data on the information system built was taken from sample data in the design and construction of a web-based car rental management information system using the waterfal method [13].

The following are the stages of data collection in the research in obtaining data, including:

1. Literature Studies
   Literature study is learning that is carried out based on theories and literature in the library. This data collection method is carried out by studying, reading and searching for various existing references, be it books, journals, papers, and so on so that they can be taken and summarized into test data according to needs.
2. Interview
   The author conducted interviews in the company with people related to building a web-based car rental management information system using the waterfal method.
3. Observation
   Observations are made to obtain complete data so that the administration of web-based car rental management can be properly systemed.

3.3 Research Modeling

The research overview was carried out with several diagram models[14]. Each diagram model shows a different function. There are several diagrams used in this study, including:

a. Use Case Diagram
   Use case diagrams provide a description of the system's functions from the user's point of view and help system analysts understand how the information system being built works[15]. This diagram illustrates the user's relationship with the system through explanations in the form of diagrams.

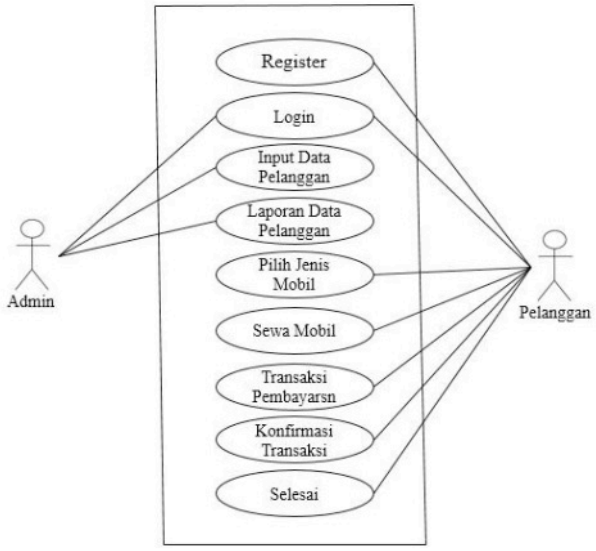

Figure 3. Use Case Car Rental Management Diagram

b. Activity Diagram

Activity Diagram describes the direction or activities carried out by users towards a web-based car rental management information system

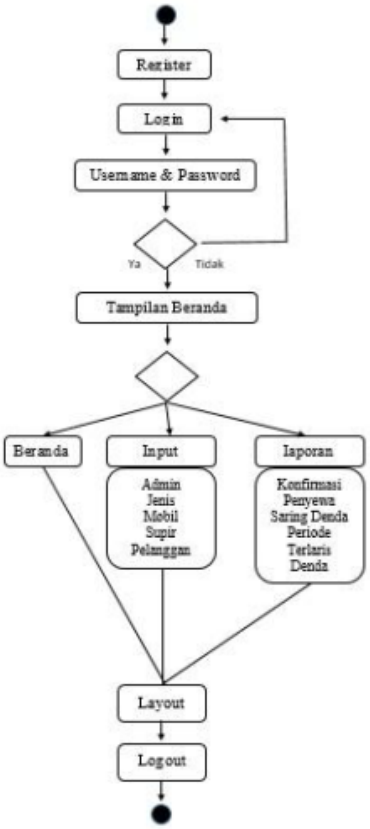

Figure 4. Car Rental Management Activity Diagram

c. Sequence Diagram

Sequence diagram is the sequence of work carried out by users in carrying out the recording of a web-based car rental management information system.

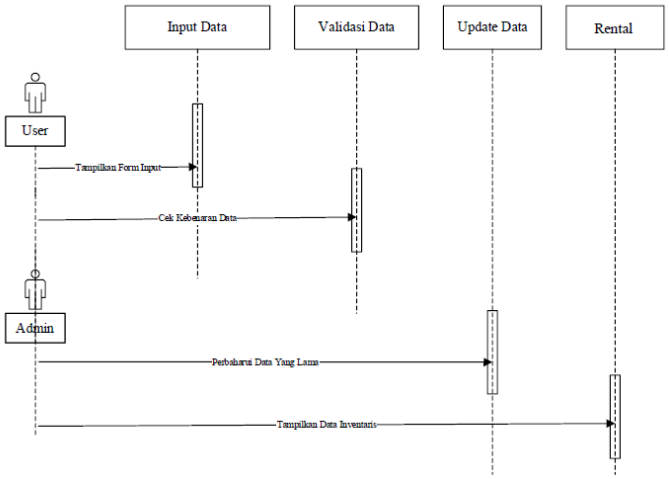

Figure 5. Car Rental Management Diagram Sequence

d. Class Diagram

A class diagram is a specification of object-oriented development and design that describes the structure and description of classes, packages and objects and their relationships to each other such as containment, associations, and others.

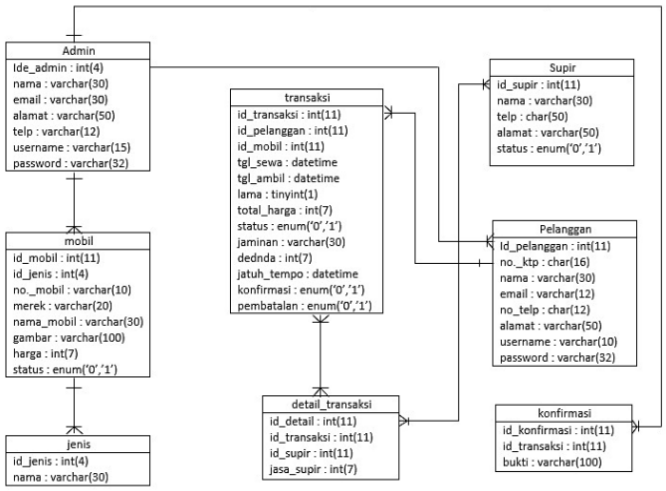

Figure 6. Archive management diagram class

IV. RESULTS AND DISCUSSION

This section describes the various implementations and interfaces of the components participating in this study, namely the implementation of a web-based car rental management information system. The research uses multiple display models in connecting users and systems. The explanation of the system will be explained in the following section.

4.1. System Specifications

System specifications are an important component that must be met to ensure that the system can run properly and optimally. In the development of a web-based Car Rental Management Information System, a system specification is needed that supports the smooth process of designing, implementing, and testing the system. This specification covers the requirements of the hardware and software used during the system development and testing process. Hardware and software have an interrelated role in building an efficient and easy-to-use information system. Both must work synergistically so that the developed website can function according to the needs of users and provide a good user experience. Therefore, determining system specifications is a crucial first step in supporting the success of system development. hardware specifications used in the research, Intel Core i5 2.5 GHz processor, 2 RAM, 500 GB Hard Disk/ SSD. Software is an interface that will carry out tasks. The software specifications used in the study are Windows 11 64bit Operating System, Microsoft Visual Studio Code Programming IDE, UI Designer App.diagrams.

4.2 Application Results

The results of the website application are built based on a design that has been designed beforehand. There are several views on the website. The following will be explained further for each page view used in this study.

a. Login Menu Page

The login menu page serves to access admins who have been registered in the web-based car rental management information system. The following image is a view from the login menu page.

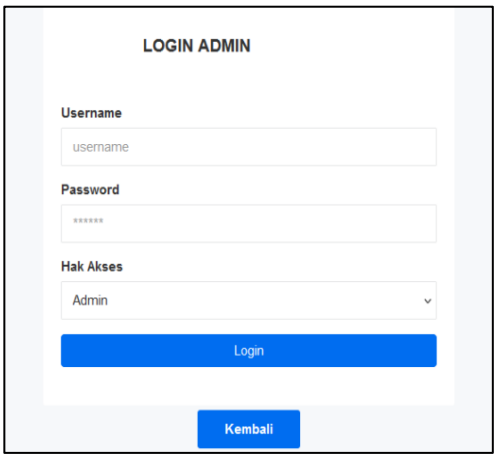

Figure 7 Login Menu

b. Dashboard Menu Page

The Dashboard menu page serves as the homepage or main page of the web-based car rental management information system. Through this page, users can see a summary of important information related to system operations, such as vehicle data count, customer data, active transactions, and reports. The interface designed on the dashboard menu is made simple, informative, and easy to use to make it easier for admins to monitor all system activities in real-time

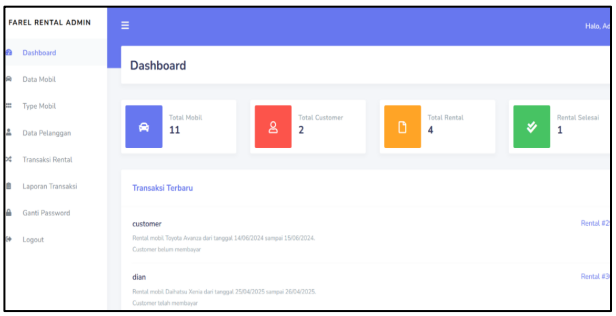

Figure 8. Car Rental Dashboard Menu Page

The app is capable of displaying graphs of temperature and humidity fluctuations, as well as air quality indicators in informative visual form. *Monitoring* platforms developed using Blynk have proven to be very helpful in data

visualization. The app's simple and easy-to-understand interface allows users, especially room management staff, to conduct monitoring without the need to have an in-depth technical background.

c. Car Data Menu Page

The car data menu page on the web-based car rental management information system displays the data of vehicles available for rent by customers. On this page, users (admins) can perform several important functions such as adding new cars, changing car data, and removing cars from the list

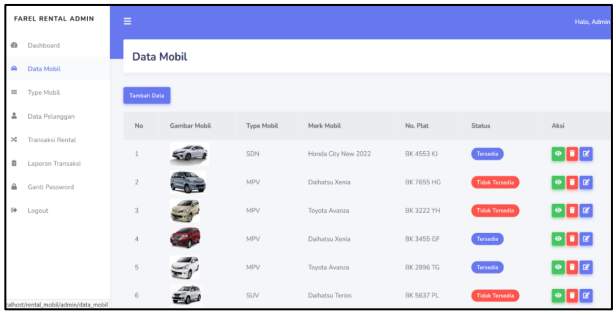

Figure 9. Car Data Menu Page

d. Car Type Page

The Car Type Data Page page on the web-based Car Rental Management Information System is designed to make it easier to manage the type or types of cars available in the system. This page allows admins to add, change, and delete car type data as needed. The interface of this page is designed to be easy to navigate and support data management efficiency. Users can see a list of different types of cars such as MPVs, SUVs, City Cars, Sedans, or Pick-Ups that are used to categorize vehicle units based on their class or function of use.

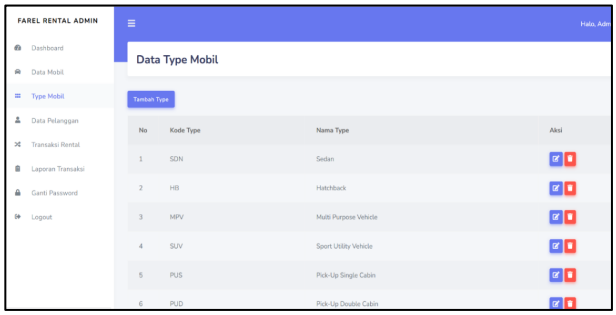

Figure 10. Car Type Page

e. Customer Data Page

The Customer Data page on the web-based Car Rental Management Information System serves as a center for managing customer information who have or will use car rental services. This page allows admins to view, add, edit, or delete customer data efficiently. The main features on this page include searching for customer data using search fields that come with filters based on customer name, phone number, or rental status. Customer data is displayed in the form of a table that contains information such as customer ID, full name, address, phone number, email, as well as action options such as view details, edit, or delete.

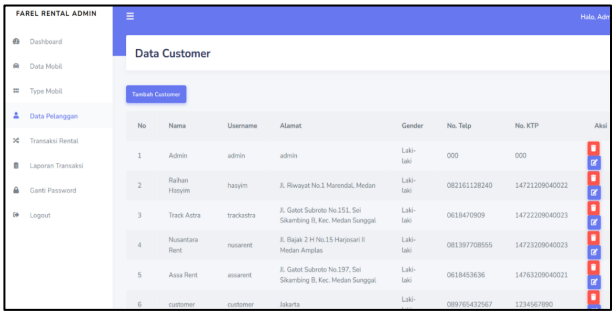

Figure 11. Customer Data Page

f. Transaction Data Menu Page

The Transaction Data page on the web-based Car Rental Management Information System is an important part of the process of managing vehicle rental activities. This page displays the history of transactions that have been made by customers, including information related to the rental car, rental duration, rental fees, and transaction status.

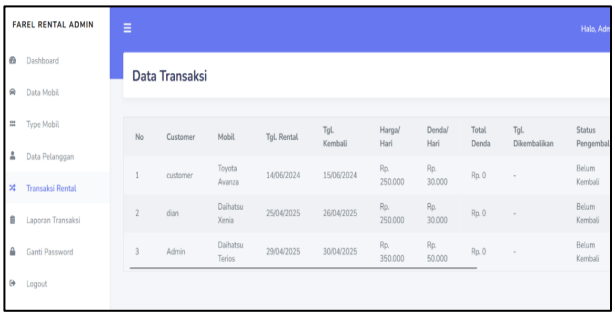

Figure 12. Transaction Data Menu Page

g. Transaction Report Menu Page

The Transaction Report page in the web-based Car Rental Management Information System functions to display a recap of car rental transaction data that has been carried out in a certain period of time. This page allows admins or management to monitor and evaluate the performance of the rental business based on the transaction data recorded in the system.

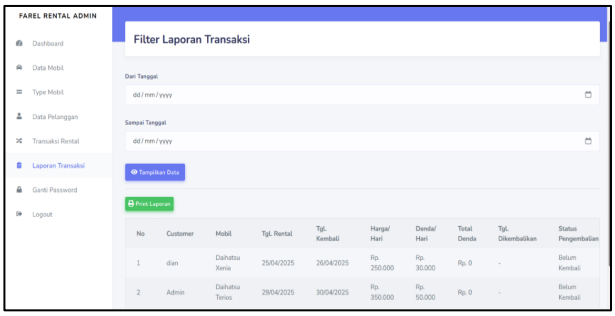

Figure 13. Report Menu Page

h. Car Rental Main Webpage

The Car Rental Main Web Page is the initial display seen by users when accessing a web-based car rental management information system. This page is designed to give you an interesting first impression while also presenting important information about the car rental services available.

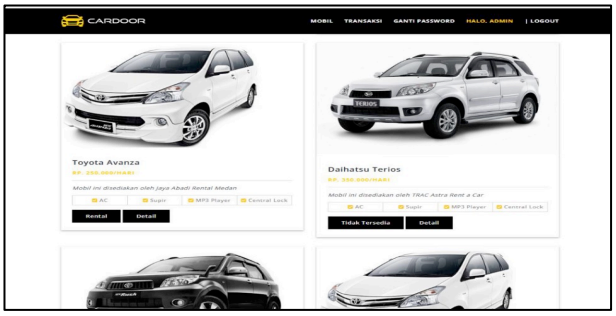

Figure 14. Archive Document Print Menu Page

The main features on this page include a list of cars available for rent, complete with vehicle photos, brief descriptions, daily rental rates, and availability status. Users can easily browse through car options, view the details of each vehicle, and make direct orders through the action buttons provided. In addition, this page also comes with a quick search feature, filters by car category (such as SUVs, MPVs, city cars, etc.), as well as customer testimonials to increase the trust of new users. Contact information and navigation to other important pages such as about us, rental terms and conditions, and contact us are also clearly displayed in the footer of the page. With a responsive and user-friendly interface, this main web page serves as the main gateway for customers to explore services and make car rental transactions online, quickly, and easily.

V. CONCLUSION

Based on the research conducted on the design and construction of a web-based car rental management information system using the waterfall method, it can be concluded that:

a. The web-based car rental management information system built successfully meets the need to manage vehicle data, customer data, rental transactions, and well-structured reports. This system makes the car rental administration process that was previously done manually, more efficient and organized.
b. With the existence of a web-based platform, users (both customers and admins) can access the system anytime and anywhere. This allows car rental management to manage data in real-time, monitor vehicle status, and make it easier for customers to make bookings.
c. The features contained in the system such as car data management, customer data, rental transactions, and transaction reports provide convenience in car rental management. In addition, with the search menu and filters, users can easily select the desired vehicle based on category, fare, and availability.

VI. DISCUSSION

It is hoped that in the future this system can be equipped with automatic notification features, such as email or SMS, to inform customers about the status of the order, reminders of vehicle return times, and other relevant notifications. This will improve customer comfort and reduce the chances of delays or other problems. The system must be constantly updated and strengthened in terms of security to protect sensitive user data and transactions. The use of data encryption and the implementation of multi-factor authentication can be an important step to ensure the security of customer data and transactions.

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