
Application of Waterfall Method in Development of Tourism Bike-Sharing Transaction Information System at JogjaBike

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ABSTRACT

JogjaBike is one of the tour bike-sharing service companies. The problem with JogjaBike is related to the lack of activities that educate customers about the flow of the rental transaction system. The tourism bike-sharing transaction information system that is implemented is still managed conventionally. Referring to the problems with JogjaBike, the purpose of this research is to design a website-based rental transaction information system at JogjaBike. The modeling used to develop information systems is the waterfall method. The results show that the system can run as expected. In addition, usability testing results with a value is 84.29 included in the NPS "Promoter" classification, Acceptability score "Acceptable", Grade Scale "A", and Adjective Rating "Excellent". For JogjaBike, a web-based tourism bike-sharing information system can be used to store data on rental transactions that have been made by customers, make it easier to prepare reports, and make it easier to evaluate business results.

Keywords: Development, Tourism Bike-Sharing, Information System, Waterfall Method

1. INTRODUCTION

Global tourism has received special attention because it is a priority source of foreign exchange in various countries, including Indonesia [1]. Referring to the Tourism and Creative Economy Agency in Indonesia, one of which is the potential for developing tourism in the sports sector. Sports tourism is one of the activities which aims to promote tourist destinations [2]. Of the many existing tourist destinations, the purpose of the sport is used as a promotion for tourist destinations [3]. The development of tourism through cycling in recent years has become very popular in Indonesia [4]. The development of sports tourism has now become a priority to increase tourist visits in order to stimulate the regional economy, one of which is Yogyakarta. Sports tourism in the service-based sector is very potential and strategic to improve the regional economy of Yogyakarta.

As one of the provinces on the island of Java, Yogyakarta is famous for tourism destinations. Yogyakarta tourism includes: cultural tourism, natural tourism, culinary tourism, entertainment and recreation, special interest, MICE (Meeting, Invention, Convention, Expo), educational tourism and shopping tourism [5]. This can be seen from the growth of tour and travel tour packages as well as tour packages which are increasing. The city of Yogyakarta is known as a friendly education city which is one of the reasons why tourists are interested in traveling. Many companies have established tourism service businesses such as Jogja Gita Tour and Travel, Moana Bike Tour, and JogjaBike.

JogjaBike is a public transportation provider company that provides bike-sharing with many types of bicycles available, such as mountain bikes (MTB), folding bikes, city bikes. JogjaBike focuses on bike-sharing services in the city of Yogyakarta, which provides tour packages. JogjaBike was launched in October 2018 [6] as an implementation of alternative modes of transportation in an effort to make Yogyakarta a smart city. The concept of the program is application-based bike-sharing, as an urban transportation innovation in the city of Yogyakarta supported by the government in collaboration with one of the local startups, PT. Trijaya Communications. Along with its development, JogjaBike is growing, assisted by the Office of Communication and Informatics as the leading sector in the development of bike-sharing applications. The Department of Transportation Yogyakarta as a partner facilitates road access for cyclists. The tourism office acts as a tourism manager because JogjaBike's goal is to support the development of existing tourist objects [7].

However, in recent years, the turnover of tourist bicycle rentals has decreased from year to year, starting with the Covid-19 virus outbreak, where there was a phenomenon of the spread of a deadly disease virus that made the government issue an order to enforce a lock-down without any activity outside the home. After one year of the outbreak, the phenomenon of seasonal cyclists reappeared. These seasonal cyclists came from various groups, who bought bicycles together due to the implementation of the WFH (Work from Home) work system. With the presence of these seasonal cyclists, it has had a major impact on decreasing turnover for bicycle rental service agencies such as JogjaBike which has experienced a lack of interest, because many people, especially in the Jogja area, mostly buy bicycles for themselves.

In addition, the presence of new competitors such as the Moana Bike Tour. Moana Bike Tour implements new features that can attract customer interest such as having an information system that displays all forms of attractive and informative offers related to cycling tourism promos and information about travel routes and safety riding equipment. The problem faced by JogjaBike is related to the absence of a structured, automated and online information system that supports all forms of activity in bicycle rental transactions efficiently as in e-commerce applications. In the business world, it can be observed that customers usually prefer a transaction that is easy, fast and can be done anywhere online, without the need to come to an outlet or offline shop first.

Later, with the creation of this information system, it is hoped that it will be able to support the ease of making transactions and making reports for JogjaBike customers and admins, as well as being able to increase customer interest which has a good impact on revenue generation through JogjaBike services which provide the best experience with new features in a website-based information system. Website or site [8] is a collection of pages that display information. A website-based information system which is easy to access, easy to understand, and more informative regarding the display of a list of types of bicycles, to the online payment transaction process. The information system design is supported by the Waterfall method.

The waterfall method is a systematic and sequential model of information system development [9]. Waterfall is included in the system development model section, namely the SDLC (System Development Life Cycle) method. The SDLC is also known as the "waterfall" approach because it consists of sequential steps [10]. The waterfall model is often referred to as the waterfall approach, because in a work system the completion is carried out sequentially from one stage to the next from the highest stage to the lowest stage. The Waterfall method is used for the stages of designing and building a directed and sequential data application [11]. This model is widely used in government projects and many major companies. The unique feature of this model is its sequential steps. It goes

down through the phases of requirements analysis, design, coding, testing, and maintenance [12][13].

Based on the background that has been described above, the objective of the research is to apply the waterfall model in building a website-based bicycle rental transaction information system at JogjaBike. The information system is made based on a website with the aim of being accessible from various software and various platforms (multiplatform). However, there is no research that focuses on the development of a website-based information system for JogjaBike tour bicycle rental transactions. For this reason, there are several summaries that can be compared with the relevance of this study, which are presented in Table 1.

Table 1. Several Studies Related to Application Design for Transaction Bike-Sharing Information System

<i>Authors</i>	<i>Output</i>	<i>Method</i>	<i>Object</i>
<i>A. Hidayat & U. Darusalam [14]</i>	<i>Application of the time charter party method in web-based camping equipment rental information systems</i>	<i>Time Charter Party Method, Waterfall</i>	<i>Sinar Adventure Store</i>
<i>N. Bagus Putu Wahyu, U. Nengah Widya, & N. Bagus Made Sabda [15]</i>	<i>E-tourism application is in the form of a website-based vehicle rental marketplace information system</i>	<i>Waterfall</i>	<i>Nusa Penida tourist attraction</i>
<i>P. Siti Yunika & Y. Iqbal [16]</i>	<i>Hostel rental payment management information system</i>	<i>UML Modelling</i>	<i>Bait Sa'da Hostel Bandar Lampung</i>
<i>P. Putu Agus Pradana Adi, S. I Putu, & N. Bagus Putu Wahyu [17]</i>	<i>Design and Build a Website-Based Vehicle Rental Information System</i>	<i>Linear Sequential Model</i>	<i>Sewadisini.com Bali</i>
<i>Z. Hadi [18]</i>	<i>Web-Based Car Sales and Rental Application Design</i>	<i>Waterfall</i>	<i>CV. Dhiyara Anugrah</i>

2. RESEARCH METHODS

This study uses the waterfall as the information system tourism bike-sharing development method. The systematic stages in software development with this method consist of identifying user needs, system modeling, software development, and implementation system. The stages of the research carried out are referred to the stages in the Waterfall method as shown in Figure 1.

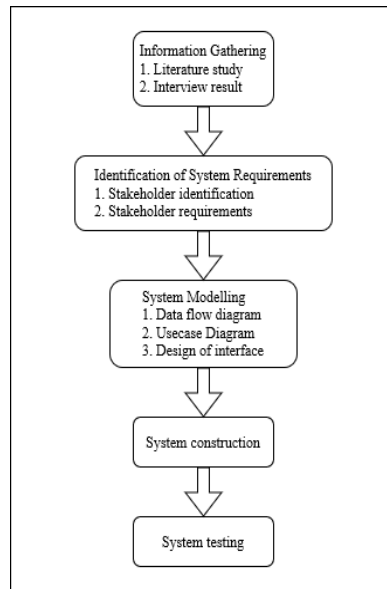


Figure 1. System Development Stages

In the first stage, various relevant information is collected for the development of the tourism bike-sharing transaction information system. In a series of interviews with the program development subsection, they discussed the scope of what is needed in building an information system based on a review of pre-existing literature. There are five previous studies that discuss developments related to leasing information systems. The information system was developed based on different needs in each of the studies discussed, observed from the geographical location and later characteristics of system users in each region.

The second stage, the information system will be identified based on the information that has been obtained from the first stage. The main thing to do in identifying is to determine stakeholders aligned with later system users, with the aim of determining success and quality in system development.

The third stage, all the information obtained will contain information about the user, seen from the details of the user's needs in the process of modeling and designing the information system that will be created. System modeling will be based on Level 0 Data Flow Diagrams, Level 1 Data Flow Diagrams, and Use Case Diagrams. With these three diagrams, you can then make a design for the interface on the information system.

The fourth stage, information system design will be carried out through a coding process using the PHP programming language with the CodeIgniter framework. The information system programming was developed using the Visual Studio Code application, according to the system requirements identified in the previous stage.

The last stage, the system that has been created will be tested to validate and verify system users. The system testing process uses the software testing method, namely black box testing, seen from the needs according to the research that has been done. The choice of the black box testing method is intended so that users gain experience when running the information system that has been designed. Apart from black box testing, there is another test used to test software, namely the System Usability Scale (SUS). The System Usability Scale (SUS) is a widely used self-administered instrument for the evaluation of usability of a wide range of products and user interfaces [19]. The System Usability Scale is used to determine whether the system has been declared fit for use or not. The detail of the proposed JogjaBike database tourism bike-sharing Information System is as following.

2.1. Information Gathering

A series of discussions were held with JogjaBike, especially the Program Development Subdivision. This initial discussion aims to explore the problems encountered related to the tourism bike-sharing transaction process at JogjaBike as a tour bicycle service provider. Several problems were identified related to the leasing process. Problems or obstacles that occur in the transaction process for this tour bicycle rental, the booking system is still done manually via chat with the WhatsApp application, and it is not yet in the form of a multiplatform system.

With the manual booking process via the WhatsApp application, the booking process and report writing by customers and the JogjaBike admin will take longer. For this reason, an information system is created that seeks to facilitate the transaction process efficiently, where the creation of this system will later make it easier for JogjaBike Admins and customers alike. The system is designed with an interface like that of an e-commerce application, where later customers who will rent bicycles for this tour can see information columns related to the availability of bicycle units, customers can determine the type of bicycle and how long to rent it without having to chat with the admin for a long time. With this information system, the payment process for tourism bike-sharing transactions can be done online, so that it can help Admin's work time. In the information system that will be created later, the Admin is only tasked with checking whether there is a transaction or not, if there is a transaction in the information system, the Admin will check a photo of proof of payment made by the customer online, if the proof of payment is correct, the Admin will approve the transaction which will then automatically the message is conveyed to customers, to be able to pick up bicycles at JogjaBike outlets in the city of Yogyakarta by showing the code that has been given by the Admin. After the transaction is complete, Admin can download the transaction report available on the information system in Microsoft Excel format.

The development of an information system for JogjaBike tour bike-sharing transactions in the city of Yogyakarta has been reviewed in various studies. From the results of the literature study, it can be used as an input benchmark for the development of information system features and design.

2.2. Identification of System Requirements

From the results of interviews with the JogjaBike program development subdivision, the information needed to establish an information system can be obtained. In the interview process it can be identified that with the main information such as transaction processing can be done online, structured, has several features and designs to support this website-based information system. Based on these results, it can be identified regarding the need for JogjaBike tour bike-sharing services, from the Admin and users. These needs are listed as follows:

1. Members who will use this website-based information system must create an account by creating an email and password, and Members are required to fill in personal data and upload photos according to the format in the information system profile menu. When finished, Members can immediately make transactions by looking at the page that shows the bicycle display. The system design will later display the types of bicycles available for rent with information on bicycle specifications as well as information on hourly rental prices, ordering and payment can be made online. As well as there are several features such as a menu of criticism and suggestions for Members as feedback on the JogjaBike tour bike-sharing service.
2. Admin will use the information system to verify the order transaction data made by the Member. The admin is in charge of approving or rejecting transactions from registered Member accounts, managing assets to be leased from rental prices, types of bicycles and number of bicycle units. Reports are written automatically by the system when a tourism bike-sharing transaction occurs, which can then be downloaded in the format Microsoft Excel without doing handwriting again manually.

2.3. System Modelling

The design system model covers Data Flow Diagrams (DFD) level 0, DFD Level 1, and use case diagrams. DFD to describe information or data flow among the activities [20]. DFD are designed to describe the flow of data in the system. DFD in object-oriented modeling aims to describe the overall function of the information system [21]. But, DFD in the use case diagram only describes the interface [22]. The fore mentioned design of the developed tourism bike-sharing information system in Figure 2 and Figure 3.

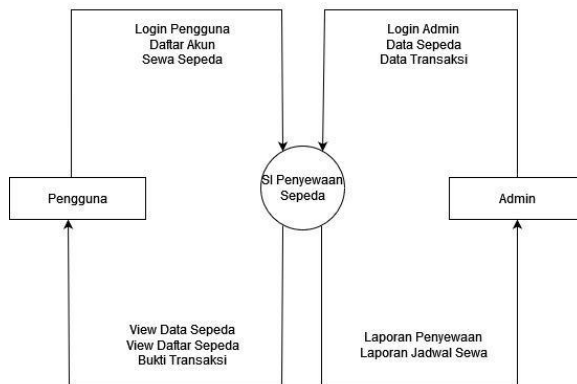


Figure 2. Data Flow Diagram (DFD) Design Level 0

Context diagram or DFD level 0 describes the scope of a system by connecting between the system and external entities, namely admins and users. The diagram gives an overview of the entire system contained in Figure 2.

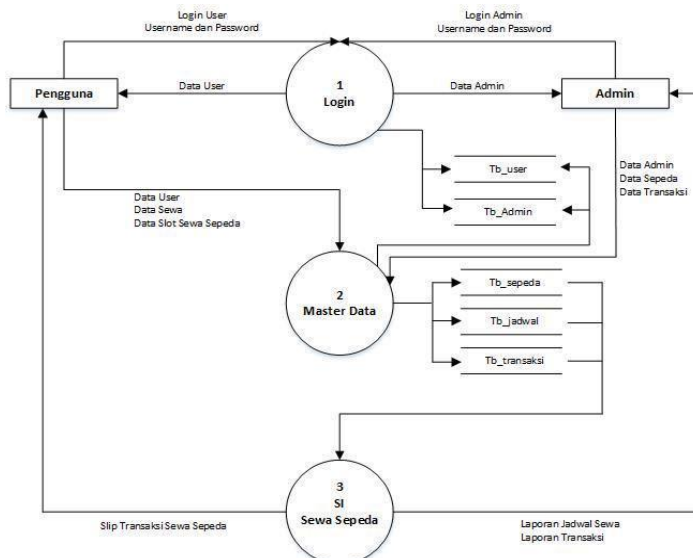


Figure 3. Data Flow Diagram (DFD) Design Level 1

There are two entities in DFD level 1, namely users and admins. There are three processes in this system, namely the login process, the master data process, and the rental process. The login

process is the initial process of entering into the system which is carried out by the admin or user by entering the registered username and password. In the master data process, the admin can add, edit, delete bicycle data in the system. The tourism bike-sharing process can be carried out by the user by making a tourism bike-sharing transaction on the system.

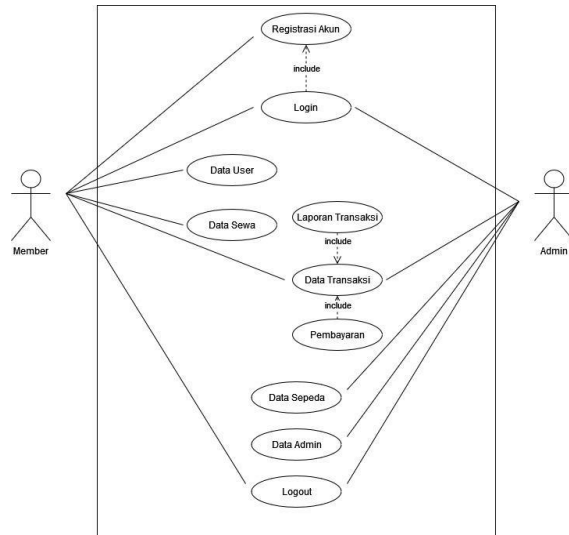


Figure 4. Use Case Diagram for Users and Admin

In the use case diagram, there are two actors, namely users and admins who are involved in the online tour tourism bike-sharing process at JogjaBike. In Actor Member it is explained that users can log in if the user already has an account. If the user does not have an account, then the registration process can be carried out by creating a new email and password. After the user can perform the login process, the user can see a display listing the types and availability of bicycle units as well as slot rental scheduling by JogjaBike. Furthermore, users can process rental transactions by using the JogjaBike tourism bike-sharing information system online. The Admin actor in this information system has authority in managing bicycle unit assets, in this case the admin can add, edit, delete bicycle data that will be rented out by JogjaBike. Furthermore, the admin's task is to manage the rental transaction process according to the data entered in the admin login information system. The incoming data is ordering a tourism bike-sharing that is in accordance with the wishes of consumers according to the slot tourism bike-sharing schedule that is already running.

The design of the interface for the website-based JogjaBike tour bike-sharing information system was designed according to the data needed from the results of interviews with the JogjaBike Yogyakarta program development subsection. There are several inputs for the interface display on the information system, including:

1. Display the agency logo.
2. Using a background interface with green elements according to the agency logo.
3. Do not use excessive color composition and images.
4. Displays a list of bicycle types along with unit descriptions and specifications.

Furthermore, in the process of making this tourism bike-sharing information system application, a coding process was carried out which was designed using Visual Studio Code. In the Visual Studio Code application, the coding process uses the PHP programming language with the Code Igniter framework, and the database uses MySQL.

3. RESULT AND DISCUSSIONS

The results and discussion contain the interface parts of the web-based JogjaBike tourism bike-sharing transaction information system using Waterfall Method. The interface on the information system is adapted to features according to the concept of JogjaBike tour tourism bike-sharing online. The main page of the information system displays the login column and the column for creating an account. The following below are the parts of the information system.

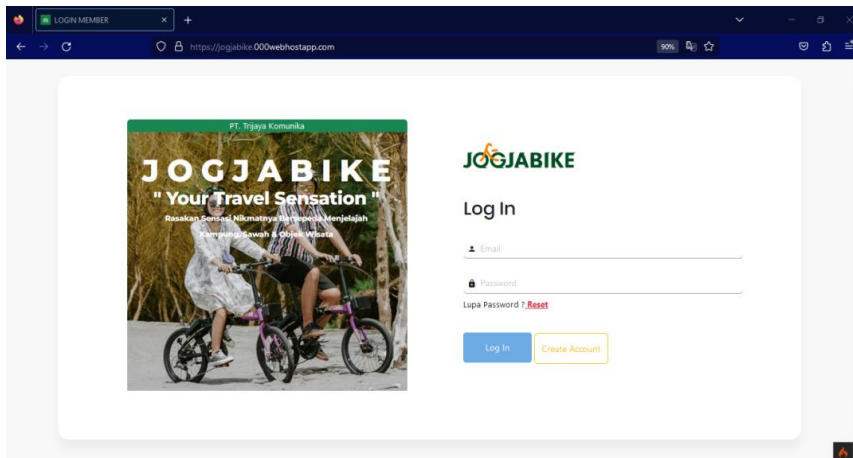


Figure 5. Login Page

The login page is a page that is used by admins and members who already have an account and password to be able to access the website. The login page is used as a protection to protect users from parties other than the account owner. On this login page, new users will be asked to create a new account via the create account button, and fill in their complete personal data according to the format, as well as create an account email and password.

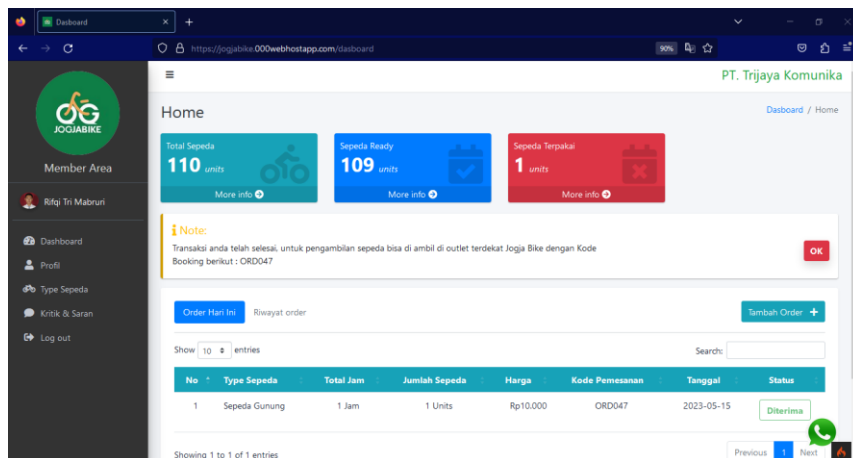


Figure 6. Dashboard Page

Admins or Members who already have an account and password can enter the system that has previously logged in on the login page. After successfully carrying out the login steps, this system has five main menus that can be accessed by users, namely the “Dashboard” menu, the “Profile” menu, the “Type of Bike” menu, and the “Criticism and Suggestions” menu. Figure 4 shows the display of the Member user Dashboard menu page. This Dashboard menu displays information in

the form of total availability of bicycle units, total units of bicycles ready to be rented out, and total units currently being rented out. There is an information table in the form of “Today's Order” information which contains related user booking data for a period of one day. And also, there is information on “Order History” which contains the user's order history. There is an “Add Order” button which then the user will be redirected to the “Bicycle Type” page. And there is a “Whatsapp” icon, if pressed it will direct the Member to the Admin contact person, as a chat facility for further information regarding tourism bike-sharing.

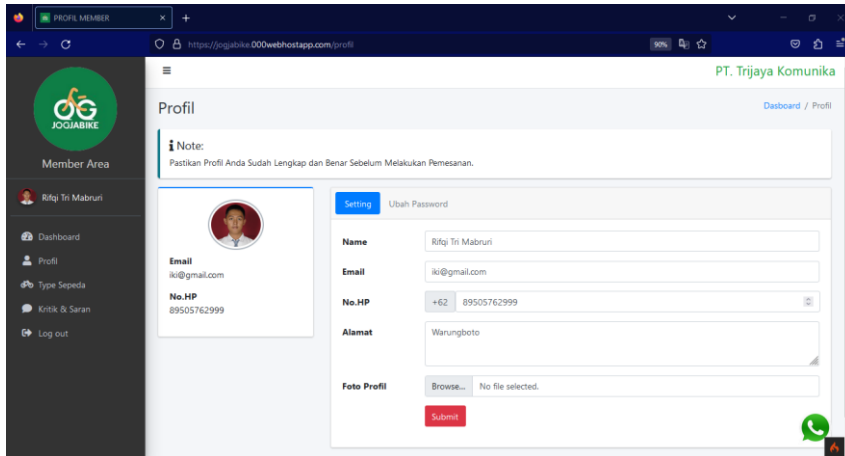


Figure 7. Profile Page

Before making a tourism bike-sharing transaction, Members are required to fill in their identity correctly on the “Profile” menu page. This “Profile” menu page functions to store and change user data in the form of name, email, mobile number, address, and profile photo, which is then used during tourism bike-sharing transactions, so that the Admin can identify JogjaBike bicycle tenants.

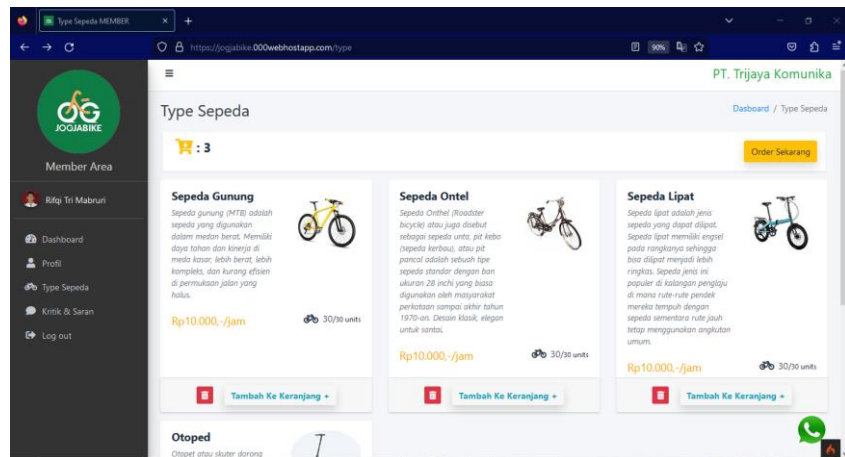


Figure 8. Bike Type Page

Members who have filled in their complete identity on the “Profile” menu page can make rental transactions for JogjaBike tourism and go to the “Type of Bike” menu page. In the “Type of Bike” menu there is information about the type of bicycle and the number of units available for each type. JogjaBike itself has several types of bicycles, including mountain bikes (MTB), city bikes, folding bikes, and others. On this menu page, Members are asked to add to the rental basket by selecting the

type of bicycle and the number of units of bicycles they want to rent, then pressing the “Order Now” button. Members enter the “Payment Form” page and then Members can adjust the rental time with the price that has been applied by JogjaBike and Members are asked to complete payments that can be made online to JogjaBike using the payment number listed on the Payment form page. The payment process has been completed, Members are required to upload proof of payment. Next, the Member is waiting for confirmation from the JogjaBike Admin.

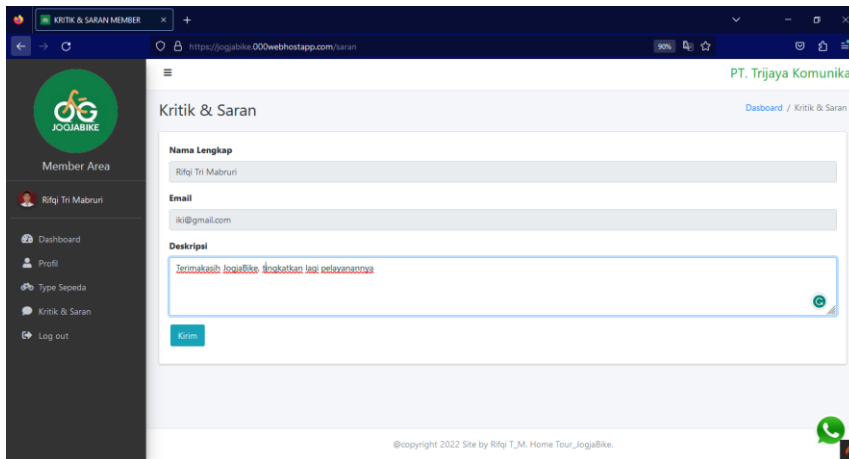


Figure 9. Criticism and Suggestions Page

Members who have finished renting JogjaBike tour bicycles can provide feedback in the form of criticism and suggestions for the Admin of JogjaBike bicycle service providers regarding rental transactions and facilities. Members are expected to provide constructive and constructive criticism and suggestions so that JogjaBike continues to upgrade its facilities and features in serving consumers.

After the development of this information system prototype, the next step is testing the information system rental transaction on prospective users, namely JogjaBike Yogyakarta. This testing is performed using the black box method related to several activities that can be managed in the information system. Table 2 shows the result of the testing step.

Table 2. Result Information System Testing

No	Tested Feature	Result	Result	Note
1	Admin	Filling and adding type of rental transaction facilitation	Succeed	Information system is performing as expected
2	Member	Development facilitation registration	Succeed	Information system is performing as expected

For trial testing, usability testing is carried out which aims to determine whether the proposed system is suitable for use or not [23]. Trial testing was carried out through distributing questionnaires containing fifteen questions as shown in Table 3. There are eight samples of respondents who are users of the JogjaBike facility registration information system rental transaction who are involved in testing.

Table 3. Item Evaluation of Black Box Testing

Code	Item Evaluation
P1	I think this rental website will really help cyclists who don't have a bicycle but want to ride a bike.
P2	Creating websites on various platforms as well as the latest detailed information on social media.

P3	<i>Easy to use in terms of functionality, but on the UI side it still needs improvement to make it easier to understand the flow of online orders.</i>
P4	<i>Very helpful online based bike renter.</i>
P5	<i>Continue to develop and modify it so that this online tourism bike-sharing base can be integrated into all tourist attractions in Indonesia, especially those that require access to tourist tourism bike-sharing.</i>
P6	<i>The range needs to be expanded again to the area around Yogyakarta.</i>
P7	<i>Facilitated in digital bicycle rental is more perfect.</i>
P8	<i>There should be special services for those who have criticism & suggestions.</i>

Furthermore, usability testing is carried out which aims to determine whether the proposed system is suitable for use or not. Unit testing was carried out through distributing questionnaires containing fifteen questions. There are 28 samples of respondents who are users of the JogjaBike facility registration information system rental transaction who are involved in testing.

Table 4. Result of Usability Testing

Resp	Item Evaluation															Sum	Score
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15		
R1	4	3	3	4	4	4	4	4	4	4	4	3	4	4	4	57	95.00
R2	4	4	3	3	4	3	4	4	4	3	4	4	3	4	4	55	91.67
R3	4	3	4	4	3	4	4	4	3	4	3	3	4	4	4	55	91.67
R4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	45	75.00
R5	2	3	3	3	3	3	2	3	3	3	3	3	3	3	3	43	71.67
R6	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	59	98.33
R7	4	3	3	4	3	3	4	3	2	3	4	4	3	3	3	49	81.67
R8	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	59	98.33
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R27	4	4	4	4	4	4	3	4	4	4	4	3	4	4	3	57	95.00
R28	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	60	100.00
Total																2360	
Average																	84.29

The usability score calculation is obtained from the total usability score of the respondent's perceptions divided by the number of respondents. The usability score that shows a value of more than 70 is included in the "Acceptable" category [2]. To get "Grade Scale A" value of must be worth at least 90 [24]. While the score is in "Adjective Rating" is considered "Good" category if the values is more than 70,4 [25]. And to get "Promoter" value of more than 90 is included in the "NPS" (Net promote Score) [26]. Reference process in measurement to find out the result of the evaluation is the level of acceptance users by category acceptability ranges, grade scale, adjective ratings, and NPS ratings.

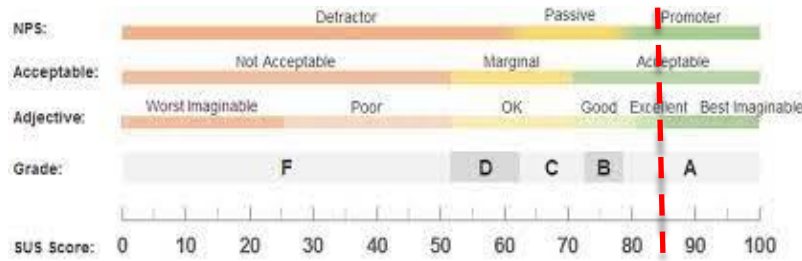


Figure 10. SUS Score Interpretation Results

Based on the calculations shows in Table 4 and Figure 5, the test and measurement results from the questionnaire given to 28 respondents for a website-based travel tourism bike-sharing information system obtained the final result of an average usability testing score with a value is 84,29 included in the NPS “Promoter” classification, Acceptability score “Acceptable”, Grade Scale “A”, and Adjective Rating “Excellent”. Thus, the proposed JogjaBike facilitation tourism bike-sharing transaction information system using the waterfall method is effective, efficiency, usable, and can be used.

4. CONCLUSION

This registration tourism bike-sharing information system is designed to have several features such information table for bicycle availability, display of a list of types of bicycles with descriptions of specifications and prices, online payment features, chat features, criticism and suggestions features, as well as report features and rental history. There are two stakeholders who will use this system, namely Members and JogjaBike. Members will act as users, while JogjaBike will act as admins. The system testing step using the black box method found that the information system can perform as expected. Usability testing results with a value is 84,29 included in the NPS “Promoter” classification, Acceptability score “Acceptable”, Grade Scale “A”, and Adjective Rating “Excellent”. For JogjaBike, a web-based tourism bike-sharing information system can be used to store data on rental transactions that have been made by customers, make it easier to prepare reports, and make it easier to evaluate business results.

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