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Designing an electronic ticketing system (E-Ticketing) for crossing transportation in Indonesia using an Object-Oriented Analysis and Design (OOAD) approach

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ABSTRACT

The purpose of this research is to analyze and design an electronic ticket system for ferry crossings in Indonesia and to analyze and design a passenger boarding pass system for ferry passengers in Indonesia. The method used in this study using literature and observation. The results of this study indicate that First, development of an electronic ticketing system (E-Ticketing) for ferry transportation modes can be a solution to help the public to obtain information and purchase transactions for ferry transport tickets in Indonesia. Second, the development of an electronic ticketing system (E-Ticketing) for crossing modes of transportation can be a solution to the problem of collecting manifest data for ferries in Indonesia. Third, development of an electronic ticketing system (E-Ticketing) for crossing modes of transportation can make it easier for people to cancel or change travel schedules. Fourth, the development of an electronic ticketing system (E-Ticketing) for crossing transportation modes requires electronic financial transaction services.

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1. INTRODUCTION

Indonesia is the largest archipelagic country in the world (National, 2015). According to the Deputy for Maritime Sovereignty of the Coordinating Ministry for Maritime Affairs, there are 17,504 islands that are included in the sovereign territory of the Unitary State of the Republic of Indonesia (Kennedy, 2021). Most of these islands are inhabited islands, especially large islands such as the islands of Sumatra, Java, Kalimantan, Bali, Sulawesi, Maluku, Papua, and so on. As an archipelagic country, inter-island connectivity is a key in the development process for people's welfare. Transportation is the key to inter-island connectivity in Indonesia.

One of the modes of transportation that is key in inter-island connectivity is the crossing mode of transportation (Ghifari & Ahyudanari, 2021). Ferry transportation is transportation that functions as a bridge connecting the road network and/or railroad network separated by waters to transport passengers and vehicles and their cargo (Humang & A. Zulfadly, 2016). The community's need for crossing transportation modes

cannot be replaced by other modes of transportation. Currently, Indonesia already has a State-Owned Enterprise (BUMN) that provides ferry transportation services, namely PT ASDP Indonesia Ferry. Ships owned by PT ASDP Indonesia Ferry are scattered throughout Indonesia's crossing routes. In addition to ships owned by state-owned companies, ships owned by private companies also provide ferry services to help inter-island connectivity in Indonesia.

However, currently it is still difficult for the community to obtain information regarding ferry services, especially in remote areas where crossing services are not carried out every day (Putra, 2019). In addition, because the operation of ferry transport ships is affected by weather factors, there are times when shipping activities cannot be carried out on a predetermined schedule so that people who have come to the port are forced to wait a long time or return home because shipping activities are cancelled. People who want to use ferry transportation services currently have to go to the port to get information related to ferry transportation services such as tariffs, schedules, and operating vessels and so on. In addition, ticket purchases are also made directly at the port (N. Aulia et al., 2021).

The current development of the digital world requires various parties to transform from conventional processes to digital processes (Sari et al., 2020). The process of selling ferry tickets is no exception. The public can of course be facilitated by selling tickets electronically because they don't have to come directly to the port just to get information and buy tickets for ferry transport. In addition, the process of recording boarding at the time of boarding the ship will be carried out more quickly because the passenger data is already stored in the electronic ticketing system.

E-Ticketing is a way to document the sales process of a travel activity without having to physically issue documents (Purba, 2014). E-Ticketing or Electronic Ticketing is a form of technological innovation in the field of e-commerce where the sales process of travel activities can be processed without having to issue physical or paper tickets. E-Ticketing reduces ticket processing costs, eliminates paper forms and increases the flexibility of passengers and travel agents in making changes to itineraries.

An information system is a combination of several components, namely people, data sources, software and hardware, policies or procedures, and anyone who can change, retrieve, disseminate, and store information in an organization. In its development, humans use information systems as a means of communication. Hardware functions as a physical unit. The software functions as a place to process incoming information. Computer network serves as a communication intermediary. The data is stored as a data source (Harsono, 2022).

Based on Bittner & Spence (2003) most of the project team did a detailed analysis of the use case model before setting stakeholders, real product needs, common goals or constraints when developing the system. This resulted in the emergence of problems, and resulted in the team not realizing that the completed system did not match the expectations of the stakeholders.

In the process of problem analysis, it is very important to ensure that there is an agreement between the parties involved with development in achieving the common goals (Arnandya Rani et al., 2019). Object-oriented analysis and design is an approach to developing systems where conditions change continuously in a short time due to the dynamic nature of the environment. This technique can be used if there is a need for routine maintenance, system adaptation, and redesign. This approach uses industry standards in modeling systems with object orientation and is called the Unified Modeling Language (UML) (Kendall & Kendall, 2011).

IBM published a Mastering Object-Oriented Analysis and Design (OOAD) with UML 2.0 guide in conducting system analysis and design activities. There are five main activity stages that must be passed, namely modeling use cases, analyzing architecture analyzing use cases, identifying design elements, and modeling data. OOAD is an analysis method that examines requirements from the point of view of the classes and objects encountered in the scope of the problem that directs the software architecture based on the manipulation of system objects or subsystems (Setiawan, 2019).

Unified Modeling Language (UML) is a "language" that has become the industry standard for visualizing, designing and documenting software systems. UML offers a standard for modeling a system. By using UML we can create models for all types of software applications, where these applications can run on any hardware, operating system and network and are written in any programming language (A. M. Aulia et al., 2022).

Based on the background above, this research was conducted to analyze and design an electronic ticketing system (E-Ticketing) for ferry transportation in Indonesian territory.

2. RESEARCH METHOD

The steps taken in this study can be seen in the following figure.

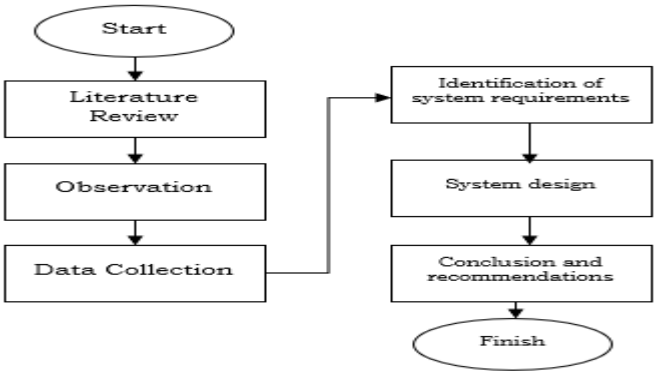

Figure 1. Research Methodology

In analyzing a system, data is needed. To retrieve data, data collection techniques for research purposes are carried out using literature studies and observations. The next stage is the identification of system requirements (Requirements), at this stage the system requirements will be analyzed and identified which will become the basis for the next stage, namely the system design stage. Then the next stage is the design stage of the system design (Analysis and Design), in this stage the system design and design uses the approach taken, namely the Object-Oriented Analysis and Design (OOAD) approach. The final stage is the conclusions and suggestions, in this stage the results of all research stages will be concluded from the data collection stage to the system design stage (Aprilia, 2022).

Problem analysis can be seen through the following table.

Table 1. Problem Analysis

Problem	Describe the problem encountered
Influence	Various stakeholders as a result of the impact of the problems encountered
Impact	Explain the impact of the problem encountered
Solution	Describe the solution to the problem encountered

3. RESULTS AND DISCUSSIONS

Problem Analysis

Based on Minister of Transportation Regulation No. 19 of 2020 concerning the Implementation of Electronic Crossing Transport Tickets, the organizers of electronic crossing transportation tickets are carried out by Port Operators or Port Operators and Port Business Entities. The organizer of the electronic ticket above can cooperate with other parties. Other parties who cooperate with electronic ticket operators must prepare an integrated electronic system with electronic ticket operators. Electronic ticket operators must provide travel information to service users. Information that must be provided to

service users, namely information on the trajectory and schedule of ferry transport vessels, rates according to the type of class and name of the ship.

In ordering tickets, service users for pedestrian passengers must fill in data at least a) Name, b)Gender, c)Age, d)Residence address, d)Identity card number, driving license or passport, and e)Phone number.

For passengers in vehicles, service users must fill in data at least a)All Passenger Names, b)Gender, c)Age, d)Residence address, e)ID card number, driving license or passport, f)Vehicle Police Number, and g)Phone number.

In the case of paying for tickets on crossings using facilities that cooperate with payment system services. Additional service fees may be charged to service users and collected together with electronic ticket purchase transactions.

Service users must first carry out the boarding process before boarding the ship. This is done to collect data on the manifest of the ship which is the obligation of the ship operator. With the existence of an electronic ticket system, the manifest data collection of ship passengers will be easier and more practical because the passenger data has been registered in the system.

Based on the description above, the electronic ticketing system that will be developed must accommodate the needs of several users, namely: a)Communities as service users, b)Port Operators as organizers of electronic tickets, c)Ship Operators as sellers of ferry transportation services

Product Perspective

The system developed will be used by the general public, especially people in Indonesia, to access information and purchase transactions for crossing transport tickets. For this reason, the ferry transportation E-Ticketing application needs to run on a public network or internet network. In addition, the system interface needs to be developed in web-based applications and smartphone applications to make it easier for users to access the services of the system.

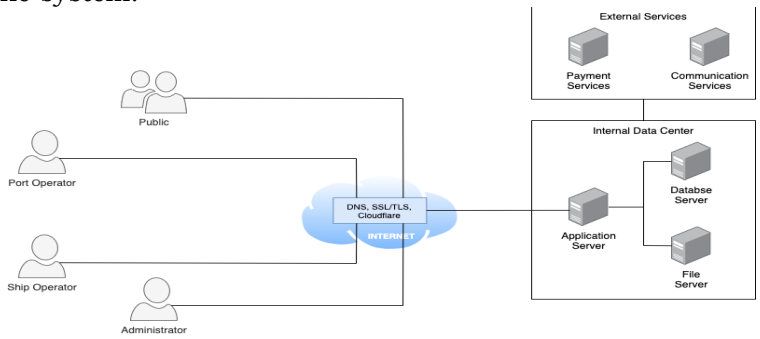

Figure 2. Product Perspective

In its operation, the ferry transportation E-Ticketing application requires integration with external Payment Services services, in this case the Payment Gateway, then Communication Services, namely Email, SMS, WhatsApp, and other communication media.

Product Functions

Based on the system requirements analysis the functionality needed in the ferry transport E-Ticketing system is as follows:

Table 2. Product Functions

No	Module	No	Submodule	Information
1	Public User	1.1	Account Registration	
		1.2	Account activation	
		1.3	Login/Logout	
		1.4	Manage Profile	
		1.5	See Ship Schedule	
		1.6	Ticket reservations	

		1.7	Ticket Payment	
		1.8	Ticket Cancellation	
		1.9	Schedule changes	
		1.10	See Order History	
2	Port Operator	2.1	Login/Logout	
		2.2	Manage Profil	
		2.3	Manage Crossing Track Data	
		2.4	Manage Ship Operator Data	
		2.5	Manage Ship Data	
		2.6	Manage Ship Schedule	
		2.7	Manage Boat Fare	
		2.8	Manage Ticket Orders	
		2.9	Manage Ticket Cancellation	
		2.10	Manage Schedule Changes	
		2.11	Manage Passenger Data	
		2.12	View Operations Report	
3	Ship Operator	3.1	Login/Logout	
		3.2	Manage Profil	
		3.3	View Ship Passenger Data	Ships Owned by Related Operators
		3.4	Redeem Boarding Pass	
		3.5	Manage Ship Manifest Data	
		3.6	View Operations Report	
4	Administrator	4.1	Login/Logout	
		4.2	Manage Master Data	Track Data, Vessel, Company Operator
		4.3	Manage User Data	
		4.4	See User Log Activity	
		4.5	View All Operational Data	
5	System	5.1	Record Log User Activity	
		5.2	Record Audit Trails Data	
		5.3	Payment Gateway integration	
		5.4	Integration With Email Servers	
		5.5	Send Electronic Tickets via Email	
		5.6	Update ticket status	Scheduller

User Characteristics

User characteristics of the ferry transport E-Ticketing system are as follows:

Table 3. User Characteristics

No	User	Information
1	Public	These users are the general public who need information and services for purchasing crossing transport tickets.
2	Designated Port Operator or Company	This user is a Port Operator or Designated Company. In this case, it has the authority to sell ferry transport tickets
3	Ship Operator	This user is a Ship Operator in this case having the authority to serve people who need crossing transportation services
4	Administrator	This user is a system administrator in this case this user has full access to the system

Limitations

The electronic ticketing system (E-Ticketing) will involve financial transactions from service users to Port Operators and forwarded to Ship Operators. In this case tickets for ferry transportation are sold by Port Operators while Service Users are served by Ship Operators. The system design in this study focuses on financial transactions from Service Users to Port Operators by involving Payment Gateway services.

The passenger validation process needs to be done outside the system. It is necessary to validate the passenger data on the system with the physical identity carried

by the passenger when boarding the ship. This is to ensure the ship's manifest data is valid. If something happens during the trip, the system can be used as a reference for the ship's manifest.

Assumptions and Dependencies

The process of financial transactions on the electronic ticketing system (E-Ticketing) that will be developed will be processed by the Payment Gateway service. The payment status for ordering electronic tickets for this crossing will be automatically updated by the Payment Gateway service. As a risk mitigation, it is necessary to make a Standard Operation Procedure (SOP) when an error occurs in the communication process of the electronic ticketing system (E-Ticketing) with the Payment Gateway. There needs to be a manual trigger for payment status when there is a problem with the integration of the electronic ticketing system (E-Ticketing) with the Payment Gateway system.

Use Case Diagrams

1) General Public Use Case Diagram

The module for the general public consists of 10 (ten) use cases as shown in the following figure.

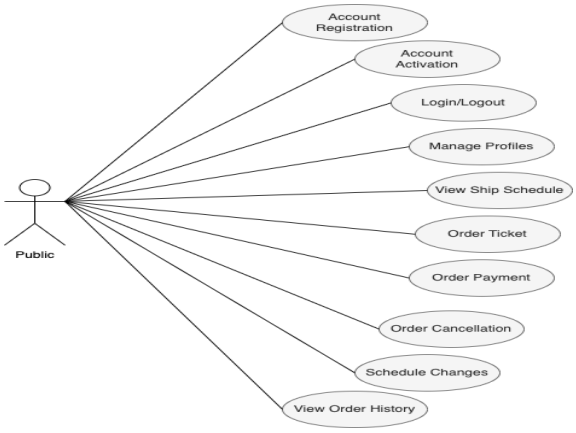

Figure 3. Use Case Diagram of the General Community

2) Use Case Port Operator Diagram

The Use Case for the Port Operator module consists of 12 (twelve) use cases as shown in the following figure.

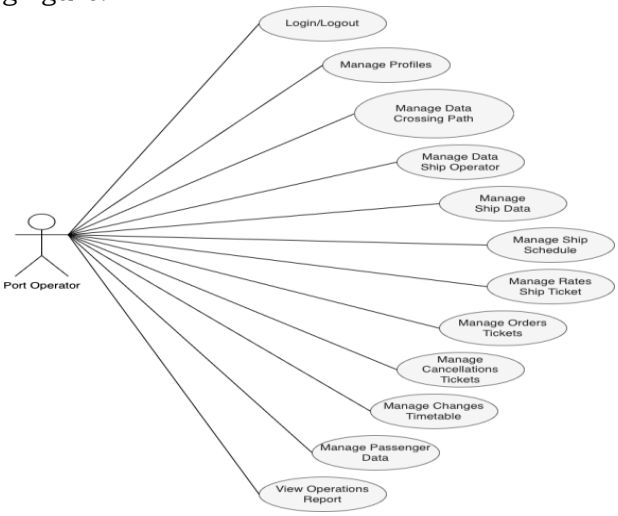

Figure 4. Port Operator Use Case Diagram

3) Ship Operator Use Case Diagram

The use cases for the Ship Operator module consist of 6 (six) use cases as shown in the following figure.

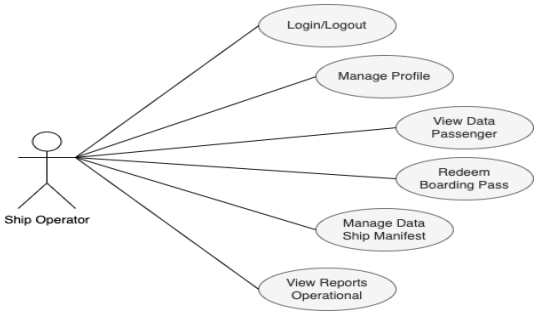

Figure 5 Use case Ship Operator Diagram

4) Use Case Diagram Administrator

The use case for the Administrator module consists of 5 (five) use cases as shown in the following figure.

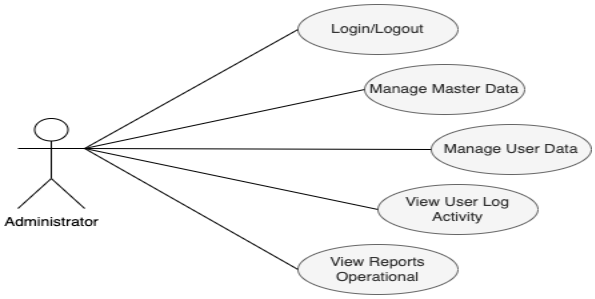

Figure 6. Administrator use cases

5) Use Case Diagram System

The use cases for the System module consist of 6 (six) use cases as shown in the following figure.

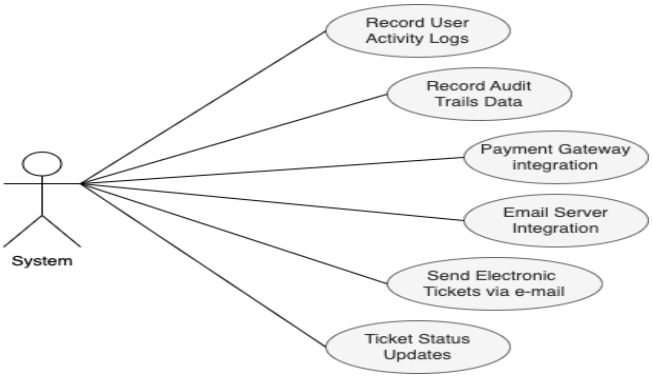

Figure 7. Use case System

Class Diagrams

Based on the use case diagram above, the following is a class diagram for the electronic ticket system (E-Ticketing) for ferry transportation.

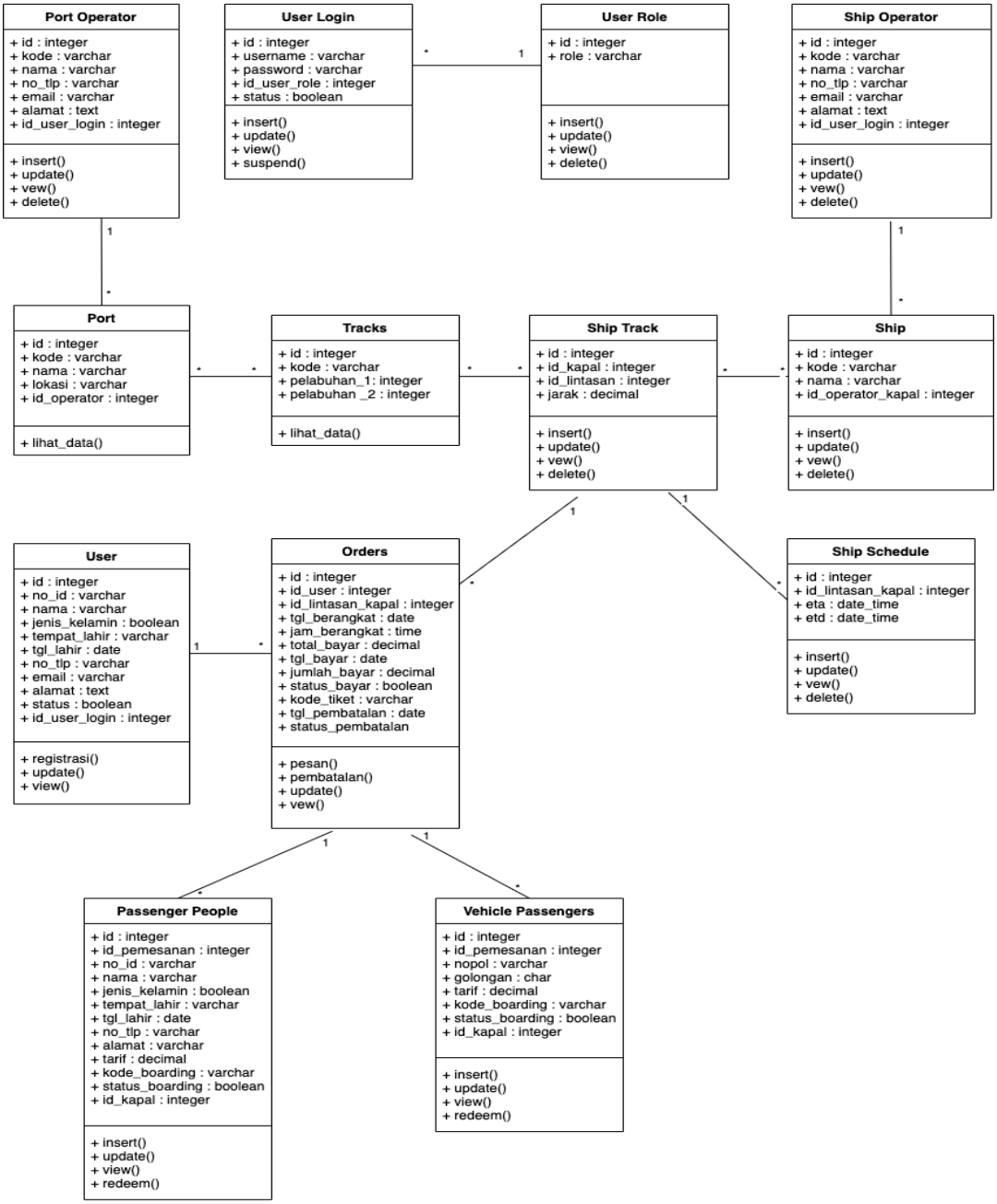

Figure 8. Class Diagrams

4. CONCLUSION

After doing the research the writer can draw the following conclusions: First, development of an electronic ticketing system (E-Ticketing) for ferry transportation modes can be a solution to help the public to obtain information and purchase transactions for ferry transport tickets in Indonesia. Second, the development of an electronic ticketing system (E-Ticketing) for crossing modes of transportation can be a solution to the problem of collecting manifest data for ferries in Indonesia. Third, development of an electronic ticketing system (E-Ticketing) for crossing modes of transportation can make it easier for people to cancel or change travel schedules. Fourth, the development of an electronic ticketing system (E-Ticketing) for crossing transportation modes requires electronic financial transaction services.

Based on the conclusions above, the writer can propose the following suggestions: First, the development of an electronic ticketing system (E-Ticketing) needs to be carried out immediately to assist the public in traveling using the crossing mode of transportation. Second, in the process of developing an electronic ticketing system (E-Ticketing) for crossing transportation, it is necessary to collaborate with electronic transaction service providers to facilitate electronic or non-cash financial transactions. Third, the electronic ticketing system (E-Ticketing) for ferry transport is included in a very critical application category so that the operational process requires Standard Operating Procedure (SOP) support and strong risk mitigation. Fourth, the ferry transportation electronic ticketing system (E-Ticketing) will involve several parties in its operations, requiring a service commitment as outlined in the Service Level Agreement (SLA) document.

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