The Development of Roll-On Roll-Off Ships Self Service E-Ticketing Systems

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Abstract: The demand for utilizing mobile-based technology to improve operational performance is getting higher. Many researchers have proven the effectiveness of mobile-based technology to support operational performance. PT ASDP is one of the parties that requires a mobile-based system to support Ferry ticket sales transactions. This need has led to the development of a mobile-based system that uses a NoSQL-based database to support real-time transactions. The system was developed with a waterfall approach and UML modeling. The test results show that the system can be used to complete Ferry ticket reservations and become the basis for developing an integrated system.

1 INTRODUCTION

Bali is a major tourist destination in Indonesia (Utama 2020), and therefore it is inseparable from tourism (Endi 2020). Bali even ranks number 4 on the traveler's choice list (Tripadvisor). There are several ways to reach Bali, one of which is using a Ferry, through the Java-Bali port. The party that manages the entire administration regarding the Ferry is PT. ASDP. It is a ferry service company for transporting people, vehicles, goods - which has 29 branches spread across Indonesia. The Ketapang - Gilimanuk Branch is one of the gateways from Java Island to Bali Island and vice versa.

The flow of passenger, vehicle and goods traffic at the ferry port continues to increase every year. During peak conditions, long vehicle queues often occur. It was because the ticket reservations and registration process was still managed manually. On the other hand, reducing waiting times is important (Sandberg Hanssen and Larsen 2020), since it can increase well-being (Guan et al. 2020). (Adducul and Adducul 2020) argued that the adoption of mobile technology could drive efficiency in ticketing. This argument is also supported by (Sahinboy 2020) and (Corsi et al. 2013) by showing a ticketing system implementation scenario. Potential solutions that mobile-based systems can also offer include reduced fragmentation, authentication problems, etc. (Corsi et al. 2013).

Moreover, knowing the passenger or vehicle data as early as possible could help plan the sequence of vehicle arrivals, which can increase the efficiency of the time it takes to load the vehicle (Bayliss et al. 2020). All of this background encourages the development of Roll-on Roll-off Ships Self Service E-Ticketing Systems. This research aims to develop a ferry (roll on roll off ships) self-service e-ticketing systems at PT. ASDP Indonesia Ferry Ketapang-Gilimanuk Branch. Which the outcome of this research could accelerate record vehicles and passengers' ferry service time.

2 PREVIOUS RESEARCH

This research was conducted based on previous research results that had been carried out as a comparison material to be studied. The research that will be compared will not be far from the topic of discussion, namely regarding the administrative service information system for vehicle crossing.

In journal entitled Information Systems for Ordering and Purchasing Ship Tickets Based on Sms Gateway at PT. ASDP Indonesia Ferry (PERSERO) Jepara explained that his research is to design and build a system that can help manage administrative
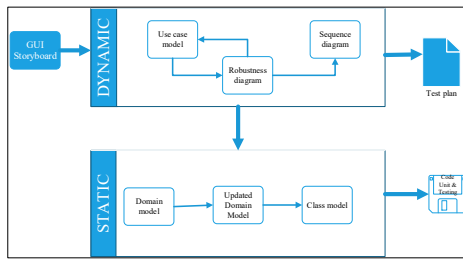
Figure 1: ICONIX Process.

services at PT. ASDP Indonesia Ferry (PERSERO) Jepara, from ordering to purchasing boat tickets. Through this designed system, the admin can record ship departure schedule data on the web system. Besides that, the admin can also record data on customers who have made orders via SMS on the web system. The admin can select "Pay" as a sign that the customer has done payment and print tickets and print reports of data - data that have made payments on the web system. Meanwhile, customers can check departure, ticket reservations, and ticket payments via an SMS gateway.(Pada et al. 2014)

In this study, there are several similarities with the research above, including both to design a system that can help manage administrative services at the port, from planning such as ordering to purchasing boat tickets. But in the research above, the information system provided in the admin does not have a feature to process SPB issuance, types of ships and docks that can be operated. In contrast, the research that will be made by the author has features to process SPB issuance, types of ships and piers that can be operated. On the web system.

Ordering boat tickets in the Riau islands currently still using the conventional method, where passengers buy tickets at The counter then pays directly to the officer and gets proof of purchase in the form of a ticket and the ticket is held by each passenger during the trip by boat. In scientific writing entitled Designing Ship Ticket Sales Application Using Near Field Communication (NFC) on this Mobile Device, the author tries to make a prototype for ship ticket sales system design using NFC devices. The system design will utilize e-KTP (electronic Identity Card). The design results are in the form of application prototypes on the client-side and server-side. The client-side on the mobile device uses the Android operating system, and the server-side uses a web application to store ticket sales transaction data so that it is expected to automate ticket sales transaction data. (Kurniawan et al. 2018)

This study has several similarities with the author's research, namely about storing user information data so that it can be used in transaction activities to the client-side of mobile devices with the selection of the android operating system and the server-side in the form of a web application to store data on ship ticket sales transactions using e-KTP (Card Electronic Identity Identification) which currently supports NFC devices. However, it also has different data storage media for boat ticket sales transactions if the above research uses NFC as a transaction medium. Meanwhile, in this research, the use of the QR Code is a medium of transactions in helping to manage administrative services at the port.

3 METHODOLOGY

The system development life cycle adopted was the waterfall. This approach was chosen, considering that the system requirements could be obtained at the beginning of development. For the design stage, this study uses the ICONIX process approach.

The ICONIX Process (Figure 1) is all about building software designs from behavioral requirements, step by step. In other words, it is about writing the user manual first (or at least a few paragraphs at a time, in use case form) as well as double-checking the use cases to make sure that the scenario takes into account and that behavior description that has been written is the behavior that the person needed. The second phase was defining a set of objects (classes) with a proper set of attributes and operations to implement the required behavior. The ICONIX process can be broken down into the following steps, which can be seen in Figure 1 : (1). Identify domain objects (domain modeling), (2) Determine use cases, (3) Conduct robustness analysis and identify gaps in the domain model, (4) Allocating behavior to objects (sequence diagram), (5) Complete the static model (class diagram), (6) Doing code writing (source code), (7) Perform system testing and user acceptance. (Rosenberg et al. 2005)

Due to the limited space, detailed development stages included in this paper was: planning, design, coding, and testing which will be explained in the following sub-section.

3.1 Planning

There were two activities at these stages. (1) Data collection, system requirements analysis related to business processes was carried out by interviewing the related units: the Public Relations and Legal Division. (2) The second stage is to analyze the system requirements, which were running at PT. ASDP Indonesia Ferry Ketapang Branch.

Figure 2 describes that all passengers and / or vehicles that will cross from the Ketapang-Gilimanuk port must first register with the android system that has been provided. If the schedule is available, the passenger must enter the passenger and vehicle data manifest on the Android system.

Passengers will get a QR-Barcode that will be scanned in parking area of the Ketapang-Gilimanuk port, suppose a passenger and / or vehicle enters the dock. In that case, the field officer will scan the QR-Barcode, convey the vehicle and / or passenger data to the administrator, so that the administrator issues the SPB.
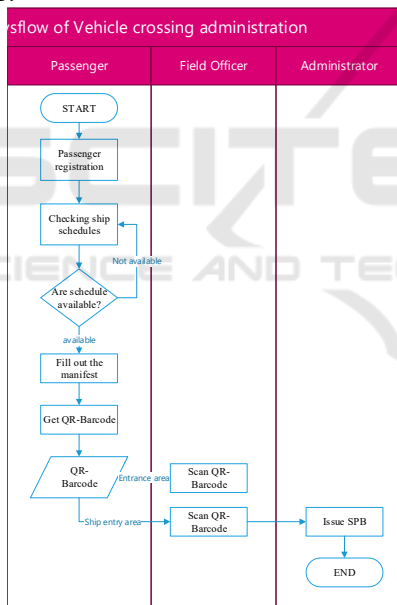

Figure 2: Cross Functional Diagram.

3.2 Design

System modeling and database modeling were developed based on the requirement gathering process, which was done at the planning stage. The modeling system used in this study is the Unified Modeling Language (UML), which is a standard to modeling the system(Grossman et al. 2005), which consists of several diagrams, namely Use-Case Diagrams, Robustness Diagrams, Sequence Diagrams, and Class Diagrams. Due to limited space, only a few sample diagrams will be shown in this paper (i.e., use case, robustness, class diagram).
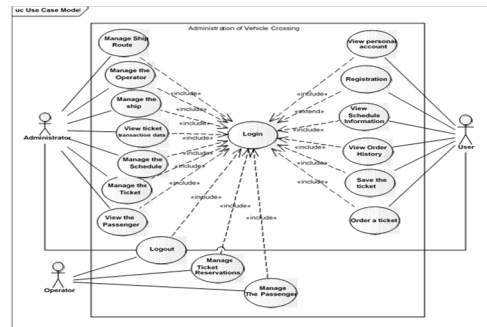
3.3 Coding

Figure 1: Use Case Diagram

Coding is an implementation of a system model design to produce a prototype of the software. The website-based system (used by port officials) uses the PHP programming language combined with HTML, CSS and Javascript. For android-based systems (used by customers) using the Java programming language. About NoSQL databases, the database used was Firebase. NoSQL suitability for large data sizes has been demonstrated in (Celesti et al. 2020). Because it encourages flexibility (Atzeni et al. 2020), it has good performance (Jose and Abraham 2019), (Ravat et al. 2020), although some RDBMS features are not available (González-Aparicio et al. 2018).

3.4 Testing

The Testing process focuses on the features and functionality of the entire system, which is reviewed by the end-user. The approach used in testing this research is Black-Box Testing.

4 RESULT

4.1 Use Case

Three act ors is involved in the systems, see figure 3. (i.e. Customer, Administrator, Operator). The administrator is the authorized party to manage transaction data. Administrators have the main task: manage ticket data, schedule and ship routes. The user is the party ordering the ticket. User/customer has a main role: registration, viewing schedule information, ordering tickets. Operators are port

officers who are authorized to manage passenger data.

4.2   Robustness Diagram

Figure 4 is one of the robustness diagrams of the system that are considered important, ticket reservations, which is why it is shown in this paper. It can be briefly explained that, after the user reviews the ticket order (order review) and the ticket order confirmation (ticket order), the user will be directed to the ticket detail page, as well as the system will run the Ticket Booking model.
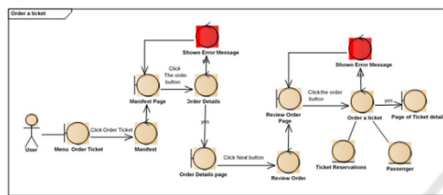
4.3   Database

Figure 4: Robustness Diagram

The type of database used is NoSQL. NoSQL was chosen with the consideration that the system can run in real-time.
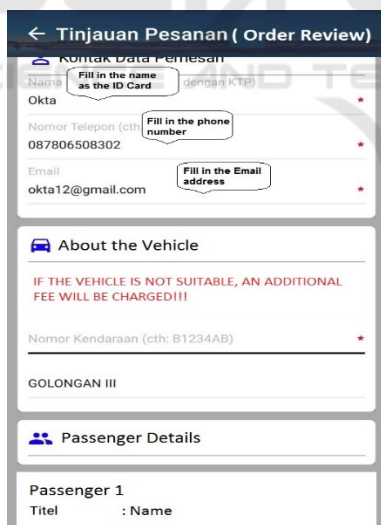

Figure 5: Ticket Reservation

NoSQL is a database that does not use relationships between tables. It is open source and can partition large data, perform queries, replicate data, and support consistency. NoSQL stands for Not Only SQL, which means that NoSQL does not only depend on the SQL programming language.

Data storage in a NoSQL database does not need to be a table. Based on the data structure, NoSQL has four categories, namely Key-Value Data Store, Column Oriented Data Store, Document Oriented Data Store, and Graph-Based Data Store.

4.4   Graphical User Interface

The system interface for an Android-based application is shown in Figure 5. The user must enter some data: customer, vehicle and passenger details. All of this data will be validated at the boarding gate at the port.

5   CONCLUSION

This paper has demonstrated the steps to develop Roll-on Roll-off Ships Self Service E-Ticketing Systems. The system was developed with a waterfall approach and accommodated the needs of 3 actors. Port Officers use a web-based system, while customers can place orders using a mobile-based application. The database used is firebase with NoSQL technology so that it can run in real-time and can support large volume transactions.

The design of the Systems was carried out by applying the ICONIX Process model, which displays four diagrams: use case diagrams, robustness diagrams, sequence diagrams (due to limited space has not shown in this paper) and class diagrams. The database used was Firebase, which supports NoSQL.

The Systems have three different actors, namely Administrators, Operators, and Users, as system users based on android. Thus each user can obtain information in accordance with their respective roles, and data integration can be carried out between users.

Business processes in this system are generated through an analysis process. This process results in a use case diagram, including ordering tickets, saving tickets, canceling tickets, and scheduling crossing.

This research has some limitations. The developed system only covered two ports: Ketapang and Gilimanuk. Apart from that, this system could at least serve as a starting point for the creation of integrated ticketing (Turner and Wilson 2010), intermodal (Göçmen and Erol 2019), and collaboration as a service (Merkert et al. 2020). In the short term, there are development opportunities to implement near field communication based-system (Zupanovic 2015), and Bluetooth-based system (Campos Ferreira et al. 2020).

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