Integrated tourism transportation software design: case study of Lombok Island

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Abstract. Lombok Island is a new magnet of touristic destination, where the number of travelers grow by 13% for domestic and 15% annually for international travelers in the last ten years. In spite of this impressive growth in the tourism sector, the public transportation and availability of touristic information remain lacking. The study aims to contribute to address the above challenges, in order to support the marine tourism in Lombok. Following the Intelligent Transportation Systems Architecture, the followings are undertaken, namely identification of users’ need, design of functional and communication architecture, and the design of an application mockup. The analysis shows that the deployment of a mobile application would save considerable time and money for both travelers and transport operators. The introduction of a mobile app would be justified, as its investment is economically feasible, and its benefit cost ratio of 1.8.

1. Introduction
Lombok Island is a new magnet of touristic destinations, located in Nusa Tenggara Archipelago, Indonesia. Lombok Island offers the natural beauty of beaches, weather, sunrise and sunset. The island is currently being developed as a part of strategic national tourism development project.

Despite of the growing popularity of this touristic island, there are two essential things remain lack in this island, which are transportation and touristic information. Lombok lacks of public transportation which connecting several places on the island. Lombok also lacks of information on touristic attractions. The travelers should make more efforts to find public transportation, touristic attractions and destinations, and suitable hotels.

A common practice is that based upon the previously collected information on Lombok Island, the travelers must rent a private car to bring them to their destinations. This could be very costly, especially when they travel alone or in a small group, while the public transportations are poorly organized [1].

The aim of this research is to contribute addressing touristic managerial challenges on the island with a solution by providing information in the right way. The hypothesis is by providing travelers and service providers with sufficient information, better quality of tourism service could be achieved. Costs savings and higher travelers’ satisfaction could be achieved as well. This would benefit all in the long run.

2. Methodology
In order to design the software, the following steps are taken [2,3]:

[2] and [3] refer to unspecified sources or references.
1. Information collection on touristic attractions, accommodation, important locations and transportation services;
2. Documenting travelers’ experiences and views on their visit to the island, through:
   a) Interviews;
   b) Online and offline questionnaire;
   c) Observation;
   d) Statistical analysis
3. Solving transportation problem
   a) Determine distances;
   b) Determine route;
   c) Determine transportation costs
4. Constructing Intelligent Transportation System (ITS) architecture
   a) Functional architecture;
   b) Communication architecture;
   c) Mockup design.
5. Software evaluation
   a) Cost-benefit Analysis;
   b) Economic feasibility analysis.

2.1 Tourism Visit Statistics
The traveler’s arrival by ship have grown 5% and 7% by plane annually, in the period of 2006-2018. A projection is made with the above growth rate is applied as exhibited in Figures 1 to 6.

![Figure 1. Ship passenger current](image1)

![Figure 2. Airplane passenger current projection](image2)

![Figure 3. Plane visitation flow](image3)

![Figure 4. Hotel visit projection](image4)

2.2 User Condition Analysis
A questionnaire is distributed to 49 respondents. Firstly, 42% of the travelers spend less than 1 million rupiahs during their stay on the island. Only 9% of the travelers spend more than 2.5 million rupiahs during their stay of two days in average on Lombok Island (Figure 7).
Most of respondents, 88%, rely much upon available information provided by websites. This is apparently in line with a massive and growing usage of internet [4,5]. Only 12% of respondents rely on offline media such as bulletin board, newspaper and magazine (Figure 8). Figure 9 provides confirmation from the previous findings, that transportations need massive improvement. One of the ways to improve it, is by providing better information about the routes, schedule and availability of transportation services. This finding is a primary guidance for designing our ICT-based solution, to provide better information on tourism and transportation services.

3. Results and Discussions

3.1 User Need Analysis
User needs analysis is conducted to translate the requirements obtained in the previous questionnaire into a facilitation embedded in the website and app.

3.2 Functional Architecture
The functional architecture describes how the future solution would work, it is also known as business process. It contains process descriptions and their corresponding parties involved. It details the functionality of the app, how it interacts between travelers, app, server, and transportation service providers [6]. Figure 10 shows the business process of a flight ticket reservation. A mobile application to be proposed is called “Loborats”.
| Travelers | Tourist apps | Server | Transport provider Application | Public transportation providers |
|-----------|--------------|--------|-------------------------------|----------------------------------|
| Travelers want to book tickets to attractions. | Travelers press the “Public transport” button on the original display. | Data is received and processed to adjust the transportation and fare to be charged to travellers. | The transportation service provider is logged into the system. | Transportation Service Provider operates in accordance with scheduled operating hours. |
| | Travelers choose the starting point of pick-up, destination points and routes details to be displayed. | | User enters username and password. | |
| | Travelers select the transportation to be used. | | | |
| | Travelers fill in data: 1. Name of the Subscriber 2. Email address 3. Traveler Name. | | | |
| | Travelers get confirmation of orders and routes paid or request. | | | |
| Travelers receive booking. | | | | |
| Travelers need to use purchased tickets. | The user A performs the payment according to the bill displayed. | The Server receives the data, inserts it into the database and passes it to the Transportation Service Provider. | The Server displays your purchased ticket. | |
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Table 1. User needs analysis (travelers)

| Needs | Features in Application |
|-------|-------------------------|
| **Information** |  |
| Information about tourist attractions | Information page on Lombok Island tourism spot |
| Transportation and tariff information to tourist attractions | Information page on transportation services |
| Information about weather and political conditions | Information page on weather and political conditions |
| Food and lodging information | Information page on culinary & lodging |
| Flight or boat ticket information to Lombok Island | Ship and flight ticket information page |
| Location information for emergency places | Emergency information page |
| Information about the history and customs of Lombok Island | Information page on history and local customs & culture |
| Information about other traveler ratings | Testimonial page |
| Information on travel Packages | Tour packages information |
| **Tour** |  |
| Get location, testimonials and admission rates | Description page on touristic attractions and their rates. |
| Route information and seat availability | Route selection and availability of seats |
| Getting Bus transportation pricing information | Public transport tariff. |
| Get boat transportation pricing information | Ferry tariff |
| Confirm the ability to drop or not | Chatting facility between traveler and transportation service providers |
| Payment information has been received by the service provider | Chat & notification feature |
| Payment Confirmation and Transportation availability | Chat & notification feature; e-payment system is regarded as a low priority, at present |
| **Restaurant** |  |
| Dining recommendations | Testimonials and scoring of restaurants |
| Location and availability of places | Location, seat availability and chatting feature |
| **Hotel** |  |
| Hotel recommendation | Testimonials and scoring of hotels |
| Location, price and availability of places | Location, bed availability and chatting feature |
| **Plane** |  |
| Get price information and seat availability | Flight tariff and seat availability |
3.3 Communication Architecture

This figure illustrates the sequence of functions of each activity in the transportation booking process in “Loborats” application. System provides savings on activities undertaken in previous activities. Users do not need to seek information about transportation in the island of Lombok through the information search drink (Google). They simply fill in the choice of transportation modes, pickup places, destinations, pick up day and time and personal information from passengers [7,8]. After making the filling, they pay according to the tariff indicated in the system, they will get notification about the order.

![Diagram](image)

**Figure 11. Functional architecture & proposed transport communication**

3.4 Mockup

There are 4 types of display, which are main menu, public transportation providers menu, private transportation providers menu and restaurant providers menu. For public transportation and private transportation providers will accommodate fare, routes, transportation availability information as well as transport booking notifications. While the application for the food provider for the place of promotion and delivery of the owner's information to travelers. And the user application view contains options of information required according to the results of the polls that the author has done about the information.

3.5 Benchmarking

A mobile app called “Loborats” is designed in order to address travelers` need, and at the same time in order to fill in the gap on areas where other applications are lacking. There are many applications that provide ease for travelers, such as “Trip Advisor”, “Traveloka”, and “Go-Jek”.

From the Table 2 there are comparison of information provided by “Loborats” application with other applications [9].

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| Needs                                      | Features in Application       |
|--------------------------------------------|-------------------------------|
| Get a ticket to go to Lombok Island        | Ticket reservation            |
| Get pricing information                   | Boat tariff and seat availability |
| Get a cruise ship schedule to Lombok Island | Boat schedule                 |

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Figure 12. Mockup of “Loborats” for travelers

Table 2. Business process explanations individual users

| Type of information                                      | “Loborats” App | “Trip Advisor” App | “Traveloka” App | “Go-Jek” App |
|----------------------------------------------------------|----------------|--------------------|----------------|---------------|
| Information about tourist Attractions                    | ✓              | ✓                  |                |               |
| Transportation information                               | ✓              |                    | ✓              | ✓             |
| Transportation Booking (scheduled)                       | ✓              |                    |                |               |
| Transportation Booking (unscheduled)                      | ✓              |                    |                |               |
| Payment of Transportation Online                         | ✓              |                    |                |               |
| Features of chatting with transportation service providers| ✓              |                    |                | ✓             |
| Information about hotels                                 | ✓              |                    | ✓              |               |
| Hotel Booking                                             |                | ✓                  |                |               |
| Online Hotel Payment                                     |                |                    |                | ✓             |
| Information about the restaurant                         | ✓              |                    |                |               |
| Features of chat with restaurant providers                | ✓              |                    |                |               |
| Aircraft information                                     | ✓              | ✓                  |                |               |
| Flight Ticket Booking                                    |                |                    |                | ✓             |
| Online aircraft payments                                 |                |                    |                |               |
| Information about boat to Lombok Island                  | ✓              |                    |                |               |
| Information about weather, politics and social           | ✓              |                    |                |               |
| Information on general knowledge of Lombok Island         |                |                    |                |               |
| Island                                                   |                |                    |                |               |
| Information about emergency places                        | ✓              |                    |                |               |
| Information about Testimonials                            | ✓              |                    |                |               |

From the Table 2 there are 5 types of information “Loborats” can provides which can’t be provided other applications. This result answers the excellence of “Loborats” than other applications.

3.6 Investment Feasibility Analysis

After conducting cash flow analysis plan, investment feasibility need to be conducted to evaluate whether the application is feasible or not. Investment feasibility analysis is performed by using various methods, which are Net Present Value (NPV), Internal Rate of Return (IRR), and payback period [1].
| Table 3. Investment feasibility analysis |
|----------------------------------------|
| Investment feasibility analysis        |
| Investment Criteria | Unit | Value | Criteria | Min |
|---------------------|------|------|----------|-----|
| NPV                 | IDR 6,638 | OK | 0 |
| IRR                 | % | 28.7% | OK | 11.5% |
| BEP from year -     | | 5 |

By using the calculation of feasibility analysis above, the result of NPV value is IDR 6.6 billion. The IRR value is 28.7% and payback period in 5th year. Figure 13 shows comparison between initial investment, which starts at 0-year, and annual cash flow.

3.7 Time Analysis
On the chart below shows the time needed for the user to conduct activities in the booking process of transportation mode in the island of Lombok today. The graph describes two related users, a 24-hour transportation service provider and (tourist) for 19.55 hours [9]. The less time spent by some of these parties is the more losses experienced. Because the timing component requires a fee to be paid on any losses incurred by the parties Figure 14.
3.8 Cost Benefit Analysis

The cost benefit analysis in this study has been conducted by considering three (3) different viewpoints, which are the travelers, the transportation service providers, and the application company. The analysis is performed by assessing each risk, a reduced process or the opportunity to issue costs to a unit of cost, after which the process is in multiply by the number of users within a year and later Projected for 50 years by entering the company's costs and revenues therein [1,10,11].

3.8.1 Travelers

The graphics in Figure 14 explain the cost and benefits gained when travelers use the “Loborats” app. In the year 0 when travelers want to use the application then must invest communication tools one of them phone. So in the – 0 years the travelers have not benefited but already made an expense of 3 million Rupiah then the ratio of the year benefit fee to 0 is 0 (below 1), but for the year 1 because the cost incurred only for operations amounting to 1.8 million Rupiah and In the 1st year of the travelers have benefited from 2.2 million Rupiah from application usage, then in year 1 the value of the cost analysis of the benefits to 1.18 (above 1). When projected for 50 years, the average benefit cost analysis value is obtained at 1.01 and can be said to provide useful (Figure 15).

![Figure 15. Traveler benefit fee chart](image)

On the chart above explains the impact sensitivity analysis of travelers with the value of analysis of the benefits cost of using “Loborats” application. When travelers visit only 0.1 times/year or can be said 10 years to Lombok Island then the use of “Loborats” application does not provide benefits because the value is only 0.05 (under 1). This value lasts until if the visit of the travelers as much as 1.5 times/year or can be said in 3 years travelers visit 2 times with the value analysis of the benefits of 0.7 (under 1).

![Figure 16. Analysis graphs traveler visit sensitivity with value cost benefit](image)
3.8.2 Transportation service provider

Figure 17 explains the costs and benefits gained when the transportation service providers use the “Loborats” application. In the year 0 when the transportation service provider wants to use the application, you must invest in one of the communication tools of the phone. So in the – 0 years the transportation service provider has not benefited but already made a IDR 3 million expenditure, the ratio of the year benefit fee to 0 is 0 (below 1), but for the 1st year due to the cost spent only for operations of IDR 1.8 Million and in the 1st year of transportation service provider has benefited by IDR 4 million from application usage, then in year 1 the analysis value of the benefit cost to 2.16 (above 1). When projected for 50 years, the average benefit cost analysis value is obtained at 1.8 and can be said to provide useful [12].

![Figure 17. Cost of transportation service provider](image)

3.8.3 Application company

In the year to – 0 application companies have not benefited but already made an expense of 988 million Rupiah then the ratio of the year benefit fee to 0 is 0 (below 1), then for the 1st year due to the cost incurred only for the operation of IDR 1.6 Billion and in the 1st year of the application company has gained the benefit/income of IDR 1.4 billion from application usage, then in the year 1 the analysis value of the benefit cost to 0.88 (still under 1) [11,12]. New companies can get the value of the benefit cost above 1 New Year – 7. When projected for 50 years, the average benefit cost analysis value is obtained at 2.50 and can be said to provide useful (Figure 18).

On the chart below describes the sensitivity analysis of administration tariff imposed by the application company to give services for users with the value of analysis cost benefit use "Loborats" application. When the administrative tariff of the application company is only IDR 500/transaction and IDR 1,000/transaction generated analysis value of its beneficial cost benefit is 0.41 and 0.71 (Figure 19).

![Figure 18. Application fee graphs applications](image)
4. Conclusions
Based on the results of the current study, the following conclusions may be drawn:

1. The tourism business on Lombok Island is expected to continue its present growth.
   a. An array of tourism projects are being established as a part of the strategic national tourism development project, including the establishment of Mandalika GP motor sport facility and the building of a new cruise and passenger ship terminal at Gili Mas.
   b. Both local and international tourists grow by 15% and 13% respectively, in the past years, 2009-2018.
   c. Ships are the preferred transport mode over aircraft, with 31,350 and 15,339 passengers respectively. But, the growth of aircraft visits is higher, 6%, compared to the ship calls, 2%.
   d. Domestic and foreign aircraft visits in 2016 by 15,339 aircraft. With an increase trend from the year 2006 – 2016 by 6%.

2. Challenges to be overcome:
   a. A proper public transportation and tourism information is lacking.
   b. An approach to overcome the above is to organize information on public transport and tourism in the right way, by introducing a mobile app for tourists.

3. The investment feasibility analysis shows that the proposed introduction of a mobile application would benefit both tourists and mobile app operator.

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