ISAKAY: Android Based Booking System for Tri-Bike Operators and Drivers Association with Cloud-Based Data Analytics

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Abstract— Convenient routine of riding in a public transport is by at large, a primary concern of the commuters as they conform on their safety while reaching such destinations. Vital to this, transportation resembles a big role in our modern society specifically when reaching any destination while carrying goods and service not only for convenience but also safety. Since the earliest days of the industrial revolution, transportation has smoothed economic development by moving materials, resources, products, and people. Rural areas in the Philippines are known in the use of "Trikes" or Tri-bike, a motorcycle attached to a side car, in transporting from one place to another. "iSakay" is a Filipino word meaning "ride" or "to book for a ride". Due to the increasing needs of the commuters in the rural areas, ineffectiveness in communication with the drivers have still experienced and mostly, the difficulty in acquiring a ride in tri-bike becomes a problem. The researchers came up with an idea of designing and developing an Android-Based booking system that centralizes the transport management of the tri-bikes in the rural areas around the Philippines. The centralized booking system can massively produce a dashboard by means of showing data analytics via "cloud" as input and guide for the future enhancement and development of the tri-bike management system. The researchers utilized waterfall model in the development of the said software which in turns led to emanate beneficial solution to the commuters. The systems' functionality, reliability and accuracy are tested and evaluated which in turns gives a very simple yet important recommendation easing the normal problems faced by those rural areas in the Philippines.

Keywords— online commuters, booking system, tricycle, tribike, transportation, waterfall model, cloud, data analytics

I. INTRODUCTION

Romblon is one of the provinces in the Philippines located in Region 4B under MIMAROPA (Mindoro, Marinduque, Romblon and Palawan) region. It is an archipelagic province located at the middle of the Philippines composed of three major islands namely the Romblon, the capital of the province, Tablas, and Sibuyan along with seventeen other smaller islands. Among the islands, Tablas is the biggest in which airport is located. To reach the place from Manila, the visitors should ride on a bus for about 2 hours to Batangas Port. From the port, the visitor should take a Ferry to Odiongan, the main town of Tablas Island, for about 8 hours.Transport is straightforward on Romblon Island.

Cars are not that many and to get around, most people use motorbike for private use and "trikes" for public use. "Trikes" or Tri-bike, a motorcycle attached to a side car, is used by public commuters in transporting from one place to another.The purpose of the study is to design an online system that can be used in booking of tri-bikes applying the Global Positioning System (GPS) technology for navigation and location finding. Since there are several problems being encountered in the booking of tri-bikes such as long queue, difficult chance of riding during peak time, limited trikes during unholy hours and the stress in the waiting of booking trips, an automated booking system applying current technologies was designed. The system runs in a client-server technology that will run in any means of available communication devices particularly using Internet. The internet connections in different areas in the island is already improving and most of the people have their own mobile phones that could facilitate the designed technology even in the remote area. This is on-time to the current upgrading of Internet facilities in the remote areas in the Philippines. The system iSAKAY is similar in the principles of Grab and Uber usually being used in the big cities all over the Philippines. The big cities have lots of cars and different means of transportations, the applications became very successful. The researcher's designed system is dedicated to a tri-bike or tricycles available in the remote areas in the Philippines, especially in Tablas, Romblon. Using the mobile phone, the app iSAKAY can be used to book directly with the trikes operators via networks. Because of the GPS technology, the driver can easily locate the position of the customers and can directly go to the given directions via phone of the trike driver. The phone of the customer and the driver were interlinked by a major system to facilitate the booking. The major system, similar to Grab and Uber, has a central database in which the transactions are recorded and this system could allow to record the details of the drivers which include the basic information like name, address, license number, phone number, operator of the driver, etc. The major contribution of this application is it is designed for the "trikes" or tricycles and usually could use in different remote areas. The system is cloud based that all of the transactions could be recorded and data could be retrieved by the help of cloud using Internet connections. This will be of help to the Romblon community since it will solve the problems in their booking. The central system that was installed in a server has an ability to collect series of big information since the design is capable of handling big data. Even there is no big data yet to handle since the system is just starting to be used, the researcher projected that future use of that feature could help in the analyzing of future improvement of the designed system.

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Dashboards of collected data could be seen in the system to facilitate the evaluation of the bookings and help to verify the management's transactions within a period of time; per day, per, month, per year, or as needed. Collecting information using dashboard is of help not only today but also in the future. It is ambitious to provide a big data functionality for a system that is just starting but this is just an add-on feature that may contribute to the decision making of the future users. It could provide inputs not only today but in the future in the owner's planning and forecasting as part of their business intelligence techniques. Moreover, iSAKAY will answer the needs of the people in the island in booking, help the drivers in connecting people, assist management in data recording and collecting for their current and future evaluation of the future plans and enhancements.

II. STATEMENT OF THE RESEARCH OBJECTIVES

General Objective:
To develop an online booking system for OTBODA (Odiongan Tri-Bike Operators and Drivers Association) of the Municipality of Odiongan with Cloud-Based Data Analytics.
Specific Objectives:
Specifically, this study aimed to:
a. integrate GPS Technology for mapping and location finding in which data will be collected in terms of:
• Drivers Information
• Passenger Information
• Vehicle Information
• Transactions details
b. design a cloud-based online booking system that will communicate and interconnect the passengers, drivers and owners to generate useful information and records as inputs to produce data analytics.
c. test the system's acceptability using ISO/IEC 25010:2011 standard.

SCOPE AND LIMITATIONS OF THE STUDY

The system will cover Tablas Island, the remote area in the Philippines that generally uses tri-bikes or tricycles for transportation. The system uses android-based operating system for mobile phones for the booking and communications of both drivers and commuters. The proposed mobile application was developed using Android Studio and running Android version 4.4.4 Kitkat and Up. GPS technology is the main tool to be used for the mapping and navigating of the designed system. Data analytics of the system is an additional feature that could help to collect big information and the major impact of the feature will be in future use since the system will just start to be used in the remote island. This could help the future users of the system to analyze and recognize patterns through dashboards that will help them to produce inputs in their future plans and decisions making. This uses cloud technology in the management of the recording and retrieving of data and data can usually be collected during each transaction.
Other features and requirements aside from the features specified by the researcher are not part of the system. Cost benefits and infrastructure analysis are not covered by this study.

III. REVIEW OF RELATED LITERATURE AND STUDIES

Odiongan, is a coastal municipality in the Tablas island province of Romblon. It is province's commercially entry ports and most economically developed municipality amongst the rest of the 17 municipalities. Odiongan is a first class municipality in the province of Romblon, it ranked as 1st in the most Competitive Municipality in MIMAROPA Region 2018 where the basis meets the province economic dynamism, government efficiency, infrastructure, and resiliency. Odiongan is politically subdivided into 25 barangays of which the Honorable Mayor Trina Alejandra Firmalo-Fabic Heads the municipality. Its population as determined by the 2015 Census was 45,367. This represented 15.50% of the total population of Romblon province. [1] Transportation in the municipality of Odiongan ranges from private to public vehicles, there are jeepneys that transport passengers to and fro from the town proper of Odiongan to the different municipalities in the Tablas Island. Tri-Bike or Tricycle is also another means of transportation that brings passengers to adjacent barangays from the town proper. On the other hand, tri bikes are the major transportation that move passengers around the town proper and to its nearest barangays. The common commuters by these tri bike drivers are students, employees to the nearby agencies and residents of the barangays inside the town proper. To date, there are 211 active members of Odiongan Tri Bike Operators and Drivers Association (OTBODA) wherein these active members availed franchised and have legal documents as to the requirements needed by the Municipal Transportation and Regulatory Board (MTFRB), as well as the Land transportation Office. [2]
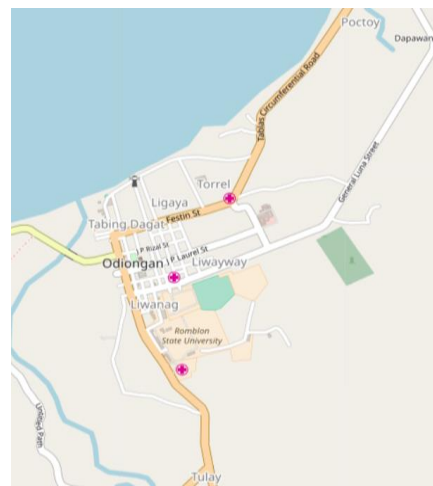

Figure 1. Municipality of Odiongan Map

Designing a system to accommodate the problems of the commuters applying online booking will contribute a lot in the navigation in the entire island, particularly in Odiongan. As part of the design, inputs to the development of the system are required to obtain the objectives. As presented in Figure 3, data are needed to design the system.

Aside from the related literatures and studies, interviews and observations were conducted to obtain the necessary contributions for the design. Hardware and software requirements were also identified to ensure that the system requirements are captured which was part also of the analysis phase. Since the system is cloud-based and will run in the network environment, computer server, personal computers, network equipment and components and smart phones were needed for the implementation of the system. As inputs to the development of the system, Android Studio, Java, Google Map and OpenStreet Map are the software infrastructures needed to produce the required solution. A need for developers, users or the drivers and operators to evaluate the system is required to evaluate acceptability of the designed system. After the inputs are defined, the process part uses Waterfall Model to ensure that the flow of the system will be guided. This was discussed and presented in Chapter 3. With the obtained inputs and presented methodology, the design of iSAKAY or Android-based booking system with cloud-based data analytics was developed. The traffic congestion in the present-day city is entirely connected to life quality and human opportunity, particularly in the cutting edge age and in the genuine globalization setting [3]. According to Rehrl, Goll, Leitinger, & Bruntsch [4] Transportation is an integral of Modern Life. A decent transportation network is one of each modernized city's underlying needs since the present current society needs versatility in each part of life. Consistently, individuals need to go to work, youngsters need to go to class, and items need to move to the destination of the supply seat. Be that as it may, as a result of the ceaseless populace development in the world, transportation systems are persistently being congested. [5] also stated that numerous legislatures worldwide have been pushing for the purported "modular move" to take care of this issue and lessen the number of vehicles stopping up street arranges by luring natives to move far from essentially utilizing private transportation models to utilizing open transportation modes. The geography of transport systems [6] states that congestions can be perceived as unavoidable consequences of scarce transport facilities such as road space, parking area, road signals, and effective traffic management. They argue that urban congestion mainly concerns two domains of circulation, passengers, and freight which share the same infrastructure. Thus, traffic congestion condition on road networks occurs as a result of excessive use of road infrastructure beyond capacity, and it is characterized by slower speeds, longer trip hours and increased vehicular queuing Urban transportation planning is designed to meet the end objective of addressing transport problems in terms of traffic movement, public transport, pedestrian, environment, and parking [7]. The tricycle (trike) is a three-wheeled, gasoline-run motorized vehicle. It is made up of a motorcycle attached to a sidecar with multiple seating and a covered roof [8]. The motorcycle, as a means of mobility, has become an issue for urban transport planners and has been expressed that such activities do not fit well with regular urban operations in the built-up district [9]. In Bangladesh, Thailand and the Philippines, light motor vehicles based on scooters or motorcycles such as baby taxis, tuk-tuk, and tricycles respectively can be observed. Particularly in the case of the Philippines motorcycle-propelled vehicles in the form of public transport in most areas rather than the use of motorcycles for personal mobility. The most likely reason for attributing this to the conversion of motorcycles into public transportation has been previously offered [10]. In the Philippines, an innovation of this, the tricycle were used as a motorized replacement of "pedicabs" or bicycles with attached sidecars in the 1950s [11]. According to Eboli [12] a tool for measuring customer satisfaction in public transport is proposed. Specifically, a structural equation model is formulated to explore the impact of the relationship between global customer satisfaction and service quality attributes. The public transport service analyzed is the bus service habitually used by University of Calabria students to reach the campus from the urban area of Cosenza (southern Italy). To calibrate the model, some data collected in a survey addressed to a sample of students were used. The proposed model can be useful both to transport agencies and planners to analyze the correlation between service quality attributes and identify the more convenient attributes for improving the supplied service. According to Orellana [13] Grab Philippines welcomed the signing of an order that allows the Land Transportation Franchising and Regulatory Board (LTFRB) to regulate the ride-hailing firms in the country, Taxi and UV's clearly belong to the 20th century whereas, TNVS belongs to the 21st century. TNVS is actually a precursor to self-driving flying taxis. Grab and Uber have become a big part to the lives of every commuter. Grab was supposed to be an alternative but it became the go-to mode of transportation of most commuters because unlike the drivers of Taxi's, they are very respectful and engaging that is why they were chosen as they provide a quality service to commuters [14].

IV. METHODOLOGY

The descriptive and developmental type of research were applied to attain the objectives of the study. It is descriptive because the researcher conducted survey in the gathering of data. Acceptability testing of the designed system was done using the formulated questionnaire compliant with ISO/IEC 25010:2011 standard. Interviews were conducted in gathering of more information as support in the development and design of the system. The study is also developmental since a system that interconnects users, drivers and trikes operators using mobile phone and network connectivity was developed as final outcome. The development of the system needs to work hand-in-hand using a tool or model that will serve as guide to meet the objectives of the study. The tools and models provide step-by-step techniques to solve requirements in each phase of the model. By careful evaluation and analyzation from gathering of data up to the development of solution, Waterfall Model was chosen as the tool to provide the required outcome. Waterfall model provides step-by-step phases in which each phase should be completed first before moving to the next phase. It is iterative that getting to reach the final phase means all of the phases should be accomplished first and the movement for each phase is similar to a waterfall flowing system. It mentioned that Waterfall is easy to understand and each phase should be completed before the developer moves to another phase.

He also mentioned that it is free from overlapping and this method was taken from the Systems Development Life Cycle (SDLC) Model.
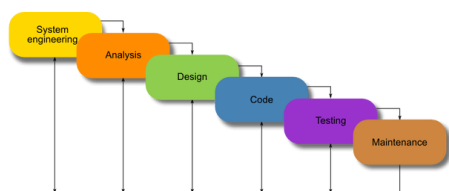

Figure 2. Waterfall Model

In "The Waterfall" approach, the whole process of software development is divided into separate phases. The outcome of one phase acts as the input for the next phase sequentially. This means that any phase in the development process begins only if the previous phase is complete. The waterfall model is a sequential design process in which progress is seen as flowing steadily downwards (like a waterfall) through the phases of Conception, Initiation, Analysis, Design, Construction, Testing, Production/Implementation and Maintenance.

As the Waterfall Model illustrates the software development process in a linear sequential flow; hence it is also referred to as a Linear-Sequential Life Cycle Model.

Sequential Phases in Waterfall Model

Requirements:

In the first phase, the Requirement Analysis, the gathering of data was conducted through interview, observations and survey. Related literatures and studies also provided inputs to formulate a design on how the system be developed. Hardware, software and other infrastructures were evaluated to ensure that the design of an online booking system will be acceptable based on the objectives of the study. Necessary inputs were carefully analyzed to capture the right data or information that will help in the design of the system. In this phase, records of the drivers and operators are important to facilitate the connections of data in the system designing. Moreover, design of the interface was also visualized in this phase as input to the design of the entire system.

System Design:

In this phase, requirements for the system's specifications were analyzed and designed. Tools and models are used to facilitate the flow and directions of the system. Design and algorithm were laid out to achieve the appropriate directions of the development of the system. The identification of hardware and software requirements were done also in this phase to justify the requirements of the entire system. Coding of software was also done in this phase based on the designed flow and algorithm.

Implementation:

In this phase, the developed programs will be analyzed and evaluated for acceptability acceptance. The functionality was tested starting from the use of the system in the administration side (the operator), the drivers, the users and IT practitioner's side. Security in the login of each module was evaluated and the acceptability was tested using ISO/IEC 25010:2011 standard.

. **Integration and Testing:**

The implementation phase activities were integrated in this phase. To ensure that functionality is complete, constant software tests were conducted. Detection and corrections of bugs were conducted in this phase to produce quality software.

Deployment of System:

After the system evaluation, the developed system was deployed in the server and configurations were conducted to link the device and the system using client-server technology. The mobile phone application connectivity was tested if it communicates directly to the main server. Updates on the records were verified to check if it functions correctly.

Maintenance:

In this phase, clients or users were given maintenance plan and training to ensure that the system could be duplicated or re install after problems are encountered. The modifications was done during the live use of the system.

V. RESULTS AND DISCUSSIONS

The system uses a mobile phone for the drivers and commuters and personal computers for the operators which are directly connected with the server via internet. The system is running using client-server technology. The server is used by the main operator that serves to be the admin of the system. The commuter or passenger will use the app in the mobile phone to book for a tricycle ride and wait until a driver accepts the booking. The driver always receives booking and once booking alerts in the mobile phone through his app, the booking is accepted and with the direction in the map, the passenger will be picked up and be brought to his destination.

Table 1. Summary of the Results of Evaluation of Primary Users for the Acceptability of the System based on ISO/IEC 25010:2011 standard.

Indicators	
Characterisitics	**Composite Mean Summary**
A. Functional Suitability	4.50
B. Performance Efficiency	4.58
C. Compatibility	4.64
D. Usability	4.73
E. Reliability	4.68
F. Security	4.66
G. Maintainability	4.62
H. Portability	4.69
General Arithmetic Mean	**4.64**

Table 3 shows the summary of the evaluation. It shows that the functional suitability results to mean of 4.50 or Highly Acceptable. This means that the function of the system satisfies the requirements of completeness, correctness and appropriateness.

The result of performance efficiency test is 4.58 or Highly Acceptable which means the system passed the performance efficiency focused in time behavior, resource behavior and capacity. This also means that the system responds from the request of the users in a very short period of time and it utilizes the entire system efficiently.

Compatibility test results to 4.64 or Highly Acceptable. This means that the system can exchange information with other systems and it does perform its required functions, while sharing the same hardware or software environment. It also means that the system passed the coexistence and interoperability test as shown in Table 3.

Usability test results to mean of 4.73 or Highly Acceptable.

This means that the system is understandable and can easily be understood by the users. This indicates that the system can be used by the users without much effort with the help of the easy-access graphical user interface.

The result of reliability test is 4.68 or Highly Acceptable which means that the system passed the maturity test, has fault tolerance in handling errors and has capability to recover or resume after failure is encountered.

Security test results to a mean of 4.66 or Highly Acceptable. It means that the system is tested secured and passed the test focused on integrity, confidentiality, nonrepudiation, accountability and authenticity.

Maintainability results to 4.62 or Highly Acceptable. This means that the designed system can analyze and diagnose the fault easily. This also shows that the system is stable and can easily be modified and tested.

Portability test results to a mean of 4.69 or Highly Acceptable. This means that the system can be moved in different places, can be installed easily and can be easily replaced other software.

The general arithmetic mean of the evaluation resulted to 4.64 or Highly Acceptable. This means that the designed system was generally accepted by the respondents as new system to provide bookings in the town of Odiongan, Romblon.
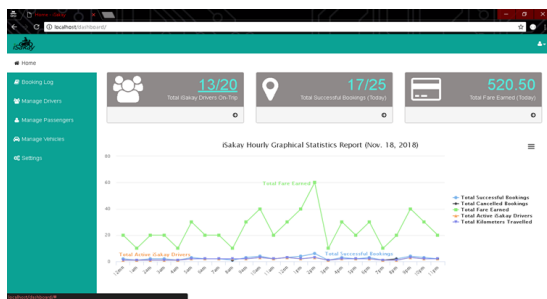

Figure 3. System Dashboard

Figure 6 shows the Home Page of the admin side. It shows the menus at the left. Booking logs can be seen by clicking the Booking Log Option. Manage Drivers menu is the menu wherein drivers' information are encoded and all details about the drivers are placed here. Manage Passengers menu is where passengers' information, records and transactions are located. Manage Vehicles is where all information about vehicles including the owners data are managed and encoded. Setting is where configuration is made. At the left side, a dashboard could be found. It shows the statistics on how many drivers are on-trip, total number of successful booking for the day, total fare earned for the day and the graphical statistics obtained based on the bookings.

VI. CONCLUSIONS

The system for online booking was developed to do the mapping and locating of passengers in a specified area. The integration of Global Positioning System (GPS) was used in the system. Collections of driver passenger and vehicle's information and transaction details were applied in the system to facilitate the recording that could be used in the booking. The cloud-based online booking system can communicate and interconnect the passengers, drivers and owners were developed and useful information and records could be collected as inputs in the collection of data to perform data analytics for future use. The system will benefit all the commuters, drivers and operators since the monitoring of trips is easy, the booking is fast and the drivers are accessible since everything works using mobile phone through network connectivity. The system was evaluated with the score of 4.69 or very acceptable based on ISO/IEC 25010:2011 standard and found out that it is capable of answering the problems of the commuters and drivers in the booking of trips in Odiongan, Romblon.

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