International Journal of Advanced Scientific Research
www.multidisciplinaryarticle.com
ISSN: 2456-0421
Received: 20-04-2024, Accepted: 12-05-2024, Published: 04-06-2024
Volume 9, Issue 1, 2024, Page No. 39-45

A Web-based revenue generation management system

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Abstract
Transportation plays a major role in every society; no developed or developing society can function optimally if there is no measure in place to facilitate the movement of people, goods and services from one place to another and as such transportation business has the potentials of generating revenue; however, the way the public transportation is run in our society has given rise to leakages and poor revenue generation from this sector. Some of the common challenges include lack of comprehensive public drivers' database, poor route and fare planning, restricted payment method and poor ticketing management system. The study proposed an improved revenue generation management system using web technology. The study is significant in the sense that it provides government with a platform to monitor daily income generated, eliminates the arguments and embarrassing incidents that passengers faced at exit point, provides details of drivers in eventuality of security or theft issues, it is user friendly and convenient, the data may be used for further research and it stored record of all commercial vehicle's operators. The methodology adopted for the study was rapid application development methodology, unified modeling language tools were used for the designs, the backend is achieved with hypertext preprocessor programming language, MyStrucrured query language was used to achieve the relational database at the backend while JQuery and cascading style sheets was used at the front end. The scope of the study is limited to revenue generation in public transportation sector using Obio Akpor local government area as a case study. The study recommended that adopting an appropriate revenue generation management system would set government in the right direction to improving revenue generation in public transportation business.

Keywords: Web-based Revenue, Generation, Drivers, Ticketing, Transportation

Introduction

Transportation plays a major role in every society; no developed or developing society can function optimally if there is no measure in place to facilitate the movement of people, goods and services from one place to another. Every sector of the society depends on transportation, for example manufacturing, agricultural or energy sectors will be required to move their products, services, from one place to another and at one point or another. The World Bank (2019) maintained that transportation is a crucial driver of economic and social development that brings opportunities to the poor and enables economies to be more competitive. It connects people to jobs, education, health services, globalization, trade, civilization etcetera. In a country like Nigeria where the main source of its revenue is gotten through the oil exportation; the recent fluctuations in oil price has left the country's economy more vulnerable; over the years government neglected other sectors of the economy that would have served as sources of revenue.

Today the country is battling with poverty, food shortage, unemployment, health challenges especially in oil producing regions, indebtedness to one financial institution or the other within and outside the country because they relied solely on oil as the main source of generating revenue. John (2019) attested to the fact that Nigeria was doing well until the discovery of oil in commercial quantity in the 1970s that distorted the fiscal and economy policy of the country and oil sucked up both domestic and foreign investments, however, the trend can be remedied if government explore the potentials in other sectors, hence, the study looked at the transportation sector as a viable source of revenue.

Revenue is defined as the income received or generated from normal business operations (Will, 2020). Some may take the role of transportation for granted; it has become increasingly necessary to harness the opportunities in the transportation sector to boost internally generation revenue especially in Nigeria where the government is indebted to so many financial institutions within and outside the country. Nigeria is endowed with vast land, waterways and space that support every type of transportation system. Revenue generation management systems used in transportation sector by private organizations have been profitable to the private organizations while in the public transportation, generating revenue has been a challenge. The revenue management systems available in the public transportation sector had not utilized and integrated all revenue sources available in the public transportation sector. The systems have not taken maximum or optimal advantage of its revenue potentials for the benefit of the society. The study explored web technology to maximize the revenue potential in the transportation sector.

Web-based revenue generation management system (WBRGMS) is an electronic revenue system that emerges to minimize the leakages and curtail fraudulent act in revenue generation processes. It ensures secure, verifiable and approved revenues by the government. The idea of adopting electronic revenue management system is to make the public transportation ticketing process easier, faster, convenient and transparent for public transportation operators especially in a country like Nigeria; this will bring about a ripple effect on internally generated revenue which will help government on the other hand for the smooth

running of the administration as well as to provide the basic needs for the people. Unlike the conventional revenue generation management system, the primary advantage of the electronic revenue generation management system is its efficiency. With conventional revenue generation process, different paper tickets must be printed for different payments and issued to public transport operators in different locations. This process is time consuming and delays users; it is also time consuming for the government official to calculate how much is generated since the tickets sales are done in different locations. Using web-based revenue generation management system makes it easy to calculate the daily income generated.

Due to technology advancement and the dynamic nature of information technology, web-based technology emerged to tackle issues associated with revenue generation in order to ensure a more secure, transparent and stress free revenue generation processes. Web-based system has a strong security foundation enabling web applications, web services etcetera to leverage the abilities to achieve more secure web solutions.

Web-based technology is accessible from any location and at any time. It allows every user to connect to the network and perform their transaction. Some transactions need to be verified or for access to be granted. All these and much more are put in place as measures to secure or prevent unauthorized users from accessing vital information. Different security measures are incorporated in web-based system which is the reason more and more businesses are adopting it. The study explored the use of web technology to ensure a more convenient, faster, secured, transparent and cost effective revenue generation solution. The web-based technology eliminates the challenges experienced in generating revenue from the transportation sector.

Problem Statement

1. Lack of comprehensive driver and passenger database
2. Poor route and fare planning
3. Restricted Payment Method
4. Poor Ticketing Management System

Purpose of the Study

1. Provide an integrated public drivers and passengers database.
2. Generate an integrated payments receipt.
3. Improve users (drivers and passengers) experience.

Obio Akpor Local Government Area

Obio Akpor is a local government area (LGA) in the metropolis of Port Harcourt, one of the major centres of economic activities in Nigeria and one of the major cities in the Niger Delta located in Rivers State. It was created in 1989 and the head quarter is at Rumuodomaya (Ayo *et al*., 2017). Obio-Akpor is bounded by Port Harcourt local government area to the south, Oyigbo and Eleme to the east, Ikwerre and Etche to the north, and Emohua. Obio Akpor LGA comprises several communities as listed in table 2. Boundary communities are Rumuola, Choba, Rukpokwu, Woji, Oginigba, Iriebe and Elelenwo. The mode of transportation in Obio-Akpor LGA is by land and the major roads are Ikwerre road, Aba road, East_West road and other popular link roads like G.U Akie, Eliozu, Oporo, Oro-Igwe, Ada-George, Woji, Obiwali, Rumuokwuta-NTA etcetera. These roads connect different communities, buses and taxis ply the major routes that link the different communities while tricycles are restricted to ply on routes that are off the major roads though some of the tricycle drivers flaunt this law. Table 2. shows the communities that make up the local
government.

Table 2: Communities in Obio Akpor Local Government Area

Communities			
Alakahia	Atali	Awalama	Rumunduru
Rumueme	Rumuigbo	Choba	Elelenwo
Egbelu	Nkpolu	Ozuoba	Rumudara
Rumuekini	Eligbam	Mgbuosimini	Rumukwachi
Oginigba	Iriebe	Rukpokwu	Rimuadaolu
Rumualogu	Eneka	Woji	Rumuosi
Rumuomasi	Rumuomoi	Elimgbu	Rumuchinda
Mgbuesilaru	Eligbolo	Orazi	Rumuowha
Rumuagholu	Rumuopirikom	Rumuibekwe	Rumuobiakani
Rumuolumeni	Rumudomaya	Rumuapu	Rumuokoro
Rumuola	Rumuokwurishi	Rumuokwuta	Rumurolu
Mgbuoba	Eliopanranwo	Ogbogoro	Mgbuodohia
Nkpor	Rumuogba	Minikpiti	Rumuesara
Eliowhani	Rumuobochi	Azumini	Miniorlu
Rukpakwusi	Oroakwor	Rumuorosi	Elieke
Rumuokparali	Rumuchiorlu	Eliozu	

Note: Adapted from "Spatial distribution of Iwhuruoha (Ikwerre) people in Rivers State, Nigeria" by C. H. Amadi, 2018, Journal of Environment and Earth science, 8(9), 2224-2232.

Loading Bits and Parks in Obio Akpor Local Government Area

The loading bits and parks are points where the commercial drivers' wait to carry passengers to different destination through the different routes they ply and are located in communities. Due to urban migration, the local government has opened up more loading bits and parks that are yet to be captured in their database; this is done for passengers to access mobility easily. Government approved parks within Obio Akpor LGA and the type of vehicles operating is listed in table 2.1. Figure 3.1: Architecture of the new Web-based Revenue Generation Management System.

Table 2.1: Loading Bits and Parks in Obio Akpor Local Government Area

Loading Bits and Parks	Vehicle Type		
	Bus	Taxi	Tricycle
Ada George by Agip		•	•
Ada George by Chinda			•
Ada George by Miniorlu			•
Ada George by Okilton/Location			•
Ada George by Pepperoni		•	•
Agip junction by Mile 4	•	•	•
Air Force junction	•	•	

Artillary 1	•	•	•
Artillary 2	•	•	•
Choba by East West road	•	•	
Choba motor park	•	•	
Eliozu			•
Market junction by Ikwerri road		•	
Oil Mill junction	•	•	•
Rukpokwu by Market junction	•	•	•
Rumuodara by East West road	•	•	•
Rumuokoro	•	•	
Rumuokoro motor park	•	•	
Rumuola	•	•	
Rumuolumeni by St. John	•	•	
Rumuomasi		•	
Rumuosi		•	
Tank by East West road		•	•
UOE school gate	•		
Wimpey by St John/Aker junction			•
Wimpey junction	•	•	•
Wimpey road by St Micheal/Gas			•
Woji by Old GRA		•	
Woji by railway		•	
YKC	•	•	•

Note**:** Reprinted from "Loading Bits and Parks in Rivers State" by Rivers State Ministry of Transport**,** 2008. https://rivtramis.riversstate.gov.ng/

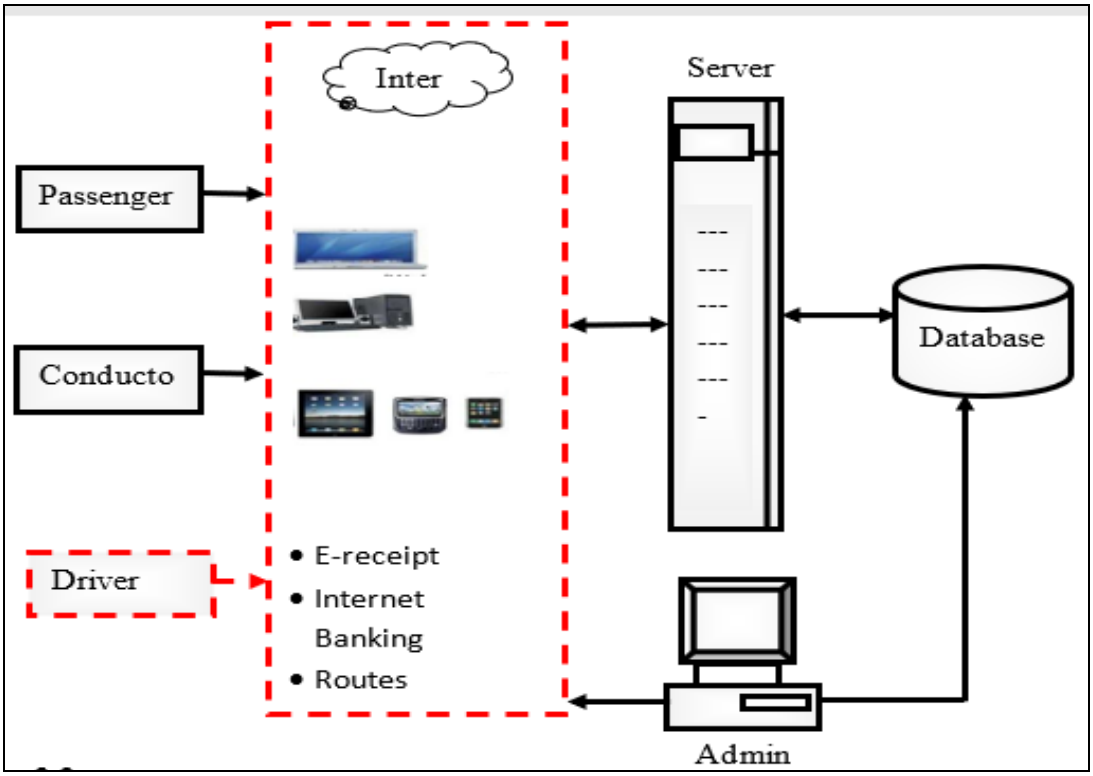


Fig 1: Architecture of the new Web-based Revenue Generation Management System

Algorithm for the new Web-based Revenue Generation Management System

1. Passengers Module

Step 1: Start
Step 2: Create account
Step 3: Login and verify account
Step 4: IF account verified Goto step 6
Step 5: Else display error Goto step 2
Step 6: Select route
Step 7: Display amount
Step 8: Make payment
Step 9: Generate payment receipt
Step 10: Else display error message, Goto step 6
Step 11: End IF
Step 12: Log out
Step 13: End

2. Drivers Module

Step 1: Start
Step 2: Create account
Step 3: Login and verify account
Step 4: Buy Ticket

Step 5: Enter National union +amount
Enter Community + amount
Enter Income tax + amount
Enter Park maintenance + amount
Enter daily booking + amount
Step 6: Ticket = ∑ Ticket + amount
Step 7: Display amount
Step 8: Select mode of payment
Step 8: Make payment
Step 9: Generate payments receipt
Step 10: End

3. Admin Module
Step 1: Start
Step 2: Create account
Step 3: Login with username and password
Step 4: View user details
Step 5: Manage ticket logs
Step 6: Update routes and fare price
Step 7: Stop

Mathematical Model of the new Web-based Revenue Generation Management System

The mathematical model is a representation of the new web-based revenue generation management system using mathematical concept as shown in figure 3.2. The e-receipt component of the system adopted linear congruential random number generation technique, though coded with alphabets and numbers to eliminate guessing the pattern in which the ticket is generated.

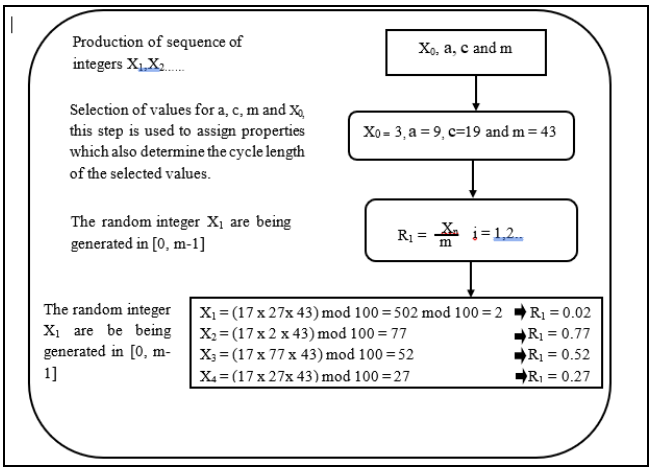


Fig 2: Mathematical Model of the new Web-based Revenue Generation Management System

Database Design of the new Web-based Revenue Generation Management System

The database design is the arrangement of data according to the model that the designer chooses but should be easy to access and secure considering the business need. The system designed has embedded in itself certain features that will enable it to adequately read data, input new data using tables, make updates on data inputted into the system and also delete data where necessary. The database is made up of the transaction table which has all the information about transactions made, route table that contains all the routes (sourse and destination where the user can select from) available or inputted, user table that contained the details of the users of the system and the ticket that shows the ticket codes that the system had generated for transactions made.

Table 3.1: Web-based Revenue Generation Management System Database Table

FieldName	DataType	Size	Description
Driver Name	Varchar	30	Driver's name
Address	Varchar	50	Driver's address
Phone number	Number	11	Contact number of driver
Car Plate Number	Varchar	10	The vehicle used for transport
Route	Varchar	20	Operation route
Date	Date	20	Current date
Account	Varchar	50	Bank details of the driver
Amount	Boolean	20	Daily ticket charge
Ticket	Varchar	20	Pin to be generated
Vehicle type	Varchar	10	Type of vehicle

4. Use case Diagrams of the Web-based Revenue Generation Management System

Use case is unified modeling language tool and it falls into the behavioural diagram tool used to model the behaviour of the web-based revenue generation management system. The use case diagrams consist of roles of each user of the web-based revenue generation management system as shown in figure 3.3 and figure 3.4 respectively. The users are the commercial vehicle operator (commercial driver), passengers and the administrator. Some roles are performed by the drivers only, others are done by the administrator only or the passengers; the application has role performed by both and the one the system does.

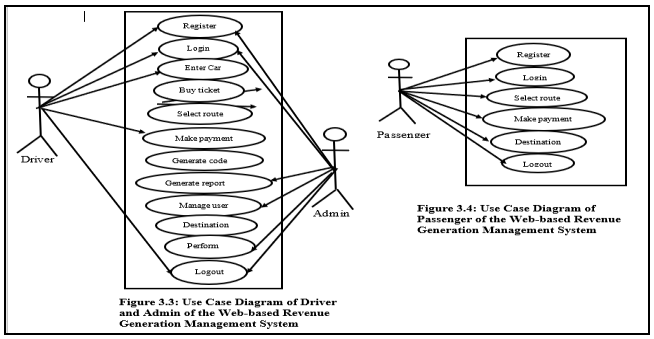


Figure 3.3: Use Case Diagram of Driver and Admin of the Web-based Revenue Generation Management System

Figure 3.4: Use Case Diagram of Passenger of the Web-based Revenue Generation Management System

Discussion of Results

Analysis of Web-based Revenue Generation Management System

The Web-based revenue generation management system (WBRGMS) is the integration of automated bus ticketing revenue generation system. The (WBRGMS) leverages on the benefit of the internet and web technology in designing a user friendly solution that is fast, easy, accessible, transparent, efficient, secured and cost efficient for public transportation operators. The web-based revenue generation management system provides a mechanism for registration of drivers and passengers alike; during registration details of users which include name, account number, car plate number, phone number, bank verification number (BVN) address etcetera are supplied to the system. The driver's phone number and car plate number are tied to the account number; this serves as a unique identifier. The web-based revenue generation systems allow users to make payment irrespective of their position or device at any time.

The system adopted a flat rate scheme for fares based on the distance covered. As the user select location and destination, the system automatically calculates the fare which is then displayed for the users to see; the platform allowed other

methods of payment for flexibility. Also, for the drivers, all the tickets to be paid for before they could work is also calculated and instead of paying per ticket, the total amount is displayed and a single e-receipt is generated for them.

Fig 1 shows the Admin Login Page of Web-based Revenue Generation Management System that enables the user to login to the dashboard and carry out their roles either from the front end or backend as it applies to the users. The screen shot in Fig 2 shows the drivers and passengers database of web-based revenue generation management system of public transportation which displays the total number of registered vehicles according to the vehicle types, amount paid for tickets, routes of the vehicles, plate numbers, dates of payment and the total amount realized daily from the users at a glance, one can get all the information needed for planning as well as monitoring the system. Also, with the information available it is easier to track and monitor drivers, should there be any security or theft issue. The database is populated through the registration page but transactions are updated as soon as payment is made. The driver and passenger database is a relational database management system (RDBMS) and was developed with MySql.

Fig 3 displayed the screen shot of integrated ticketing service of the web-based revenue generation management system. This is done to eliminate duplication and wastage of resources. The application summed up the prices of the different tickets and displayed the total amount to be paid. The total amount is displayed for user to make payment. The system will generate a payment code when payment is made. Instead of generating different codes for individual tickets, it generates a single code that serve as an electronic ticket and which is sent to the user via a short message. The interface has options for mode of payment so that the user is not restricted to one mode of payment. Fig 4 is a screen shot of the interface that enable the passenger choose the route (source and destination) and the system then calculate the fare based on the distance covered using flat rate scheme and displayed for the passenger to make payment. The system provided flexibility in the mode of payment. The verification process of the web-based revenue generation management system is shown in Fig 5. The verification is done to confirm payment of the users, when the payment is successful; the payment code is then generated. It also requires the user's consent by providing the pin. This is used as a security measure by the system. The amount is deducted from the user's account and the transaction process is completed. Fig 6 displays the code generated by the system after payment which serves as payment proof. Since the system adopts e-ticketing, this will not be printed but display a soft copy send to the users.

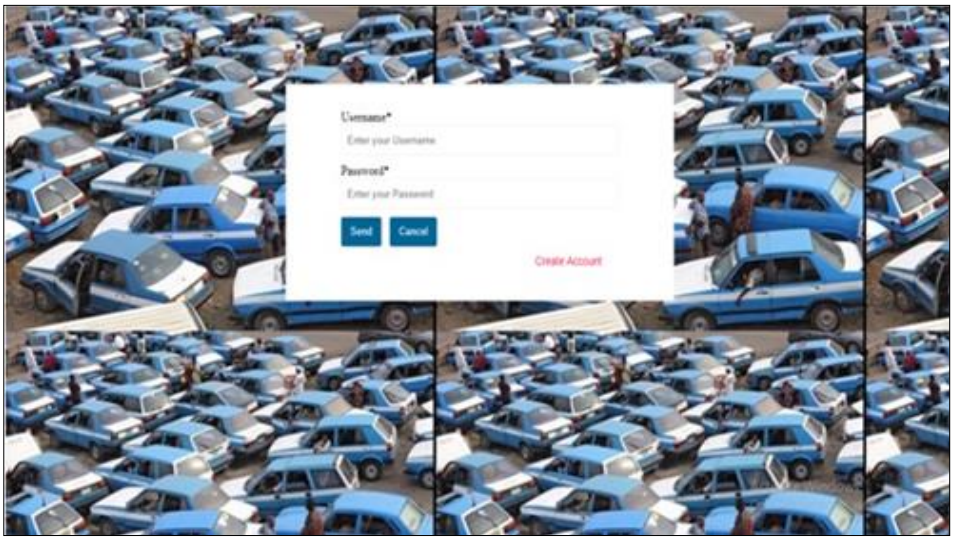
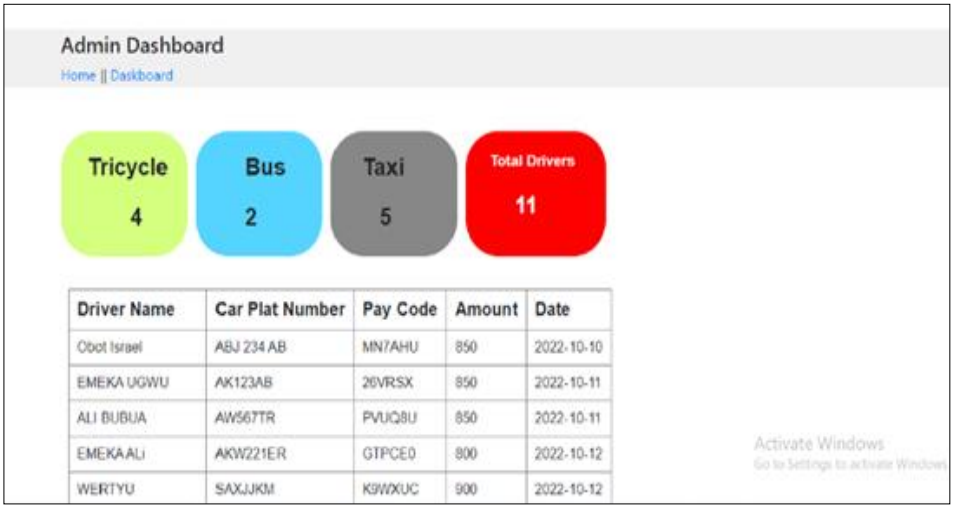


Fig 1: Admin Login Page of Web-based Revenue Generation Management System



Passenger Payment code	Passenger id	Amount	Date
9ME3S1	8cf8	200	2022-10-09 23:02:09
WHJ00K	31f3	200	2022-10-09 23:03:21
JLJ0IU	31f3	200	2022-10-09 23:04:02

Fig 2: Admin dashboard showing the Driver, Passenger, Total Vehicle Type and Amount from Ticketing Database of Web-based Revenue Generation Management System

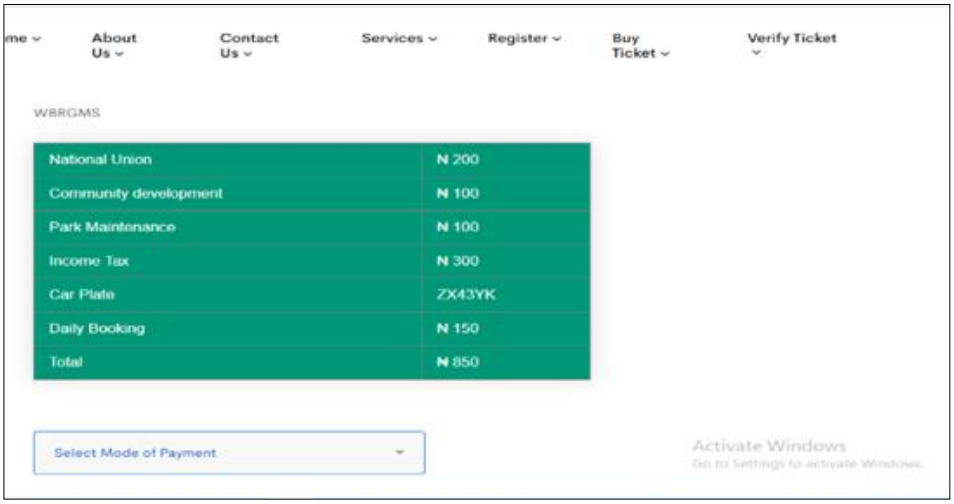


Fig 3: Screen Shot of Integrated ticketing of Web-based Revenue Generation Management System

Fig 4: Route Selection Page of the Web-based Revenue Generation Management System

Fig 5: Verification Process of Web-based Revenue Generation Management System

Fig 6: Generated Payment Code of the Web-based Revenue Generation Management System

Conclusion

The web-based revenue generation management system handles the leakages that are prevalent in the current revenue generation systems with essential security property and all revenue sources incorporated. It is aimed at designing and implementing a real application for flexible electronic payment process in the public transportation sector. The system also satisfied transparency, availability, convenience, cost effective and increase in turn over.

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