

DEVELOPMENT OF A WEB SITE FOR ADVANCED PUBLIC TRANSPORTATION SYSTEM IN MINNA METROPOLIS, NIGER STATE NIGERIA

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ABSTRACT

Traffic congestion and ineffective public transportation management remain major challenges in urban centres in Nigeria, particularly in Minna metropolis, Niger State. This study developed a web-based Advanced Public Transportation System (APTS) aimed at improving transportation management and reducing commuter waiting time through the application of Intelligent Transportation Systems (ITS). The study adopted a survey research methodology involving vehicle departure time surveys conducted across selected transport routes in Minna for seven consecutive days. Data collected were analyzed to determine vehicle movement patterns, commuter demand, and scheduling requirements. The system was developed using HTML5, CSS3, PHP, and MySQL database technologies. Findings revealed that the developed system can effectively automate trip scheduling, provide real-time travel information, reduce commuter waiting time, and improve transport service management. The study concluded that the implementation of web-based APTS can significantly enhance urban transportation efficiency in Minna metropolis.

Keywords: Intelligent Transportation System (ITS), Web site, Metropolis, Development, Commuter

INTRODUCTION

Transportation has become one of the basic necessities of human society. In recent years providing effective means of transportation has become a challenge for cities around the world. These challenges include congestion, safety, lack of proper and adequate transport infrastructure, under funding and the environmental impacts of growing traffic. It is estimated that severe congestion has an economic impact of one to three percent of GDP in developed and developing countries (Houghton et al., 2010). The first national land transport policy in Nigeria was driven in twentieth centuries, aimed to modernize transport sector (Premium Times, 2025), while Etcetera Consults Ltd, (2025) stated that smart traffic management and electric vehicles are needed for modern transportation systems in Nigeria. One of the effective ways of tackling these challenges is the use of advanced technologies in transportation systems management. The nature of the challenges and the solutions depend on the characteristics of physical developments, existing infrastructure and the behaviour of commuters.

Adeola et al., (2024) 'Leveraging Technology for Enhanced Road Transportation in Nigeria' stated that road transportation in Nigeria can be improved by intelligent transportation systems and electric vehicles. The use of advanced technologies comes under the broad category of Intelligent Transportation Systems (ITS) which encompasses a range of advanced technologies that are applied to surface transportation needs including transit and highway needs. Information and

Communication Technology (ICT) by Amadi et al., (2018) can be used in Nigeria transportation systems, and this ICT, including intelligent transportation systems improved safety, reduced congestion, and environmental benefits. The concept of ITS was introduced in the 1960s when urban areas attempted to deal with increasing traffic congestion (Singh & Kumar, 2011).

Public transportation in Minna metropolis faces significant inefficiencies that negatively impact the socio-economic activities of commuters daily, such as, lack of route information, inefficient ticketing and poor fleet management. This study specifically aimed to design and develop a web-based Advanced Public Transportation System (APTS) for Minna metropolis to digitize transit operations by mapping out major public transport route terminals and stops across Minna Metropolis using interactive Geographic Information System (GPS) and by creating a functional journey-planning module that allows commuters to view available routes and estimated travel times (Owoeye et al., 2022).

METHODOLOGY

Description of Minna: Minna is the capital of Niger State, Nigeria. The study area (Figure 1) lies between Latitude 9° 33' and 9° 40' North, and Longitude 6° 29' and 6° 35' East on a geological base of undifferentiated basement complex of mainly gneiss and magnetite. At the North –east corridor of the town lies a continuous steep outcrop of granite, which forms a limitation towards physical development in that axis. In the present

political zoning system in Nigeria, it is within the North Central Zone and occupies an area of about 884 hectares. It is about 145 kilometres by road from Abuja, the Federal Capital of Nigeria. Minna town has grown to engulf suburbs settlements such as Chanchaga, Bosso,

Maitunbi, Dutsen Kura, Kpakungu and Shango. The town is presently growing linearly along the main spine road from Chanchaga in the south to Maikunkele in the north, a distance of about 20 kilometres.

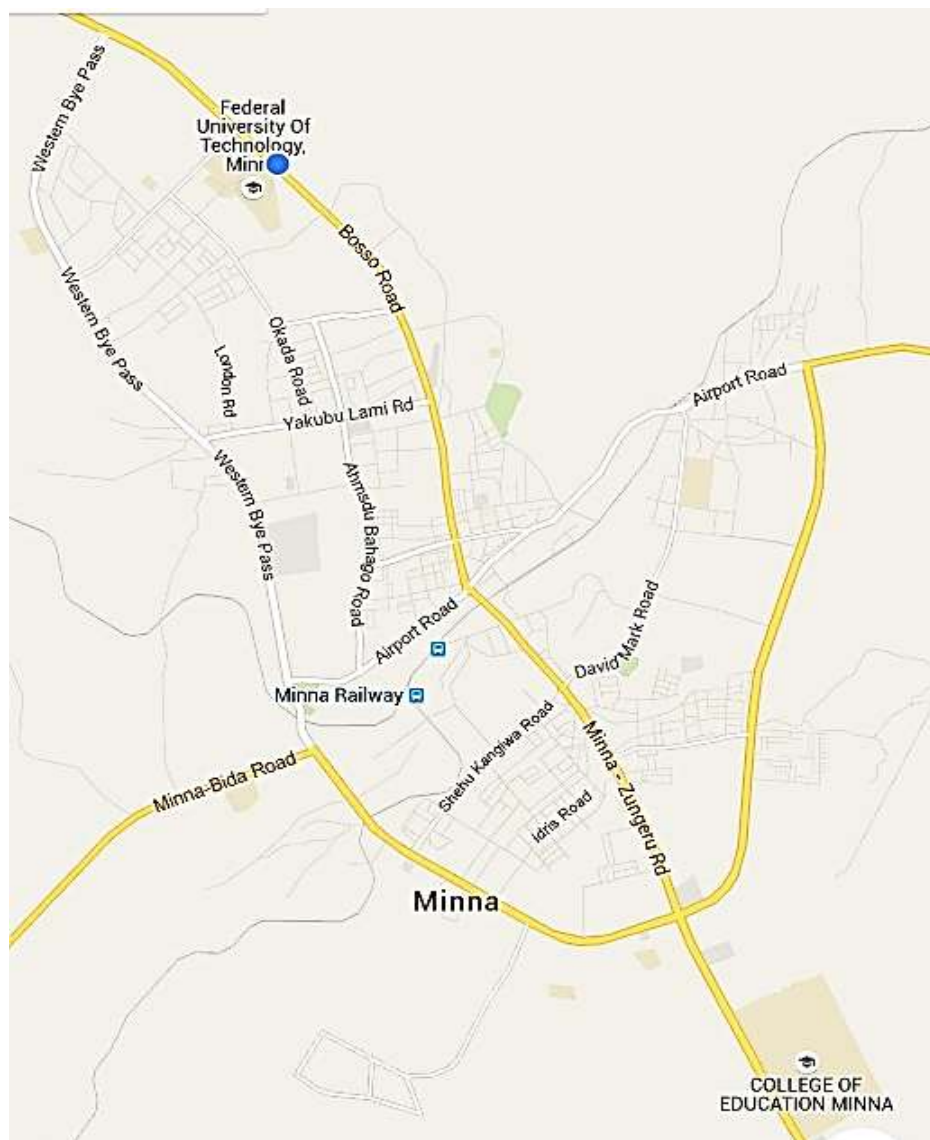


Figure 1: Map of Minna (Google Map, 2026)

Terminals and Travel Routes: Seven terminals were identified based on the original destination survey and successfully integrated into the developed software for route mapping and transport scheduling. The identified terminals served as the operational nodes of the system, while the travel routes established the connectivity between terminals.

The identified terminals are listed below:

1. Mobil roundabout bus/taxis terminals.
2. Chanchaga bus terminal
3. Bosso bus terminals.
4. Kpagugu bus terminal.

5. Maitumbi bus terminal.
6. Federal University of Technology Bosso, bus terminal.
7. Federal University of Technology permanent site, bus terminal.

The developed system successfully mapped the major travel routes between these terminals, enabling efficient route identification and transport coordination. The routes identified include:

1. Mobil roundabout- Chanchaga
2. Mobil roundabout- Bosso

3. Federal University of Technology Bosso Campus – Federal University of Technology permanent site (PS)
4. Mobil roundabout – Kpakungu
5. Mobil roundabout -Maitumbi

Vehicle Departure Time Survey: Vehicle departure time survey was carried out for 7 consecutive days on five routes used in the study. The purpose was to determine the movement patterns of the commercial buses along the selected routes and to quantify the number of buses and departure schedules that will meet the demands of the travelers (Slack,1992). Data on the departure times of the commuting buses from the terminals were collected for seven days on five routes, namely Route 1, which is the link from Mobil roundabout Terminal to Chanchaga Bus Terminal; Route 2, which is the link from Mobil roundabout to Bosso Bus Terminal; Route 3, which is the link from Federal University of Technology (FUT) Minna, Bosso Campus to FUT Minna Permanent Site (PS) Bus Terminals; Route 4, which is the link from Mobil roundabout to Kpakungu terminal, and Route 5 is the link from Mobil roundabout to Maitumbi terminal. The Survey focused on bus, taxis and tricycles

traffic. The 12-hour, 7-day survey commenced at 7:00 am and ended at 7:00pm.

Website Development: The website development was divided into phases;

- i. **User interface (UI) Development:** The user – interface was designed using Hypertext Markup Language (HTML5) and Cascading Style Sheet (CSS3) for a beautiful appearance, forms applications and to enable input of elements such as filling/collecting user’s data. HTML5 was used to design the registration forms, booking forms, etc. While CSS3 was used to handle the look and feel of the site (Kumar et al., 2024)
- ii. **Server-side scripting:** Server-side scripting was done using Personal Home Page (PHP) programming language. The PHP enables interaction / communication between the site/web pages and the database. The PHP code was scripted using Object Oriented Programming (OOP) approach to query data in the database, input, edit/ modify or delete data from the database.

My Structured Query Language (SQL) database was used to handle all data being processed from the web page.

RESULTS AND DISCUSSION

Table 1. Vehicular Departure Time along different routes and days in Minna Metropolis

Route	Day1	Day2	Day3	Day4	Day5	Day6	Day7
Departure Waiting Time (mins)							
1	87	91	85	85	93	93	81
2	48	46	45	47	50	49	46
3	87	91	85	81	76	91	77
4	139	111	119	117	115	129	116
5	85	79	87	82	82	76	83
6	144	153	156	149	147	147	149

Table 1 illustrates the variation in vehicle departure times across some selected routes during specific periods of the day. The presentation of the data was structured to distinguish between the different categories of vehicles and their operational patterns. From the analysis, an average departure waiting time of vehicles along Route 1 between days 1 - 7 are approximately between 81 – 93 minutes intervals. Also, the average departure waiting time for route 2 between days 1 and 7 fall within 45 to 50 minutes respectively. While for the average departure waiting time for days 1 to 7 are between 76 to 91 minutes. Repeating the processes for the remaining routes which are routes 4, 5 and 6 respectively for their average departure waiting time values indicate between 111 to 139 minutes; 76 to 87 minutes and 144 to 153

minutes intervals respectively. The analysis indicates that vehicle movement and passenger demand varied across the different periods of the day, with peak transport effective waiting times observed at route 6 during the period of the days. This demonstrates the need for adequate vehicle supply and effective scheduling to meet commuter demand along the identified routes as was also shown by Jimoh & Adeleke (2005). The developed system will enable easy management of transportation services through proper inventory of trips and commuters.

It should however be noted that the scope of this study is restricted to Minna metropolis and does not cover the entire Niger State or Nigeria as a whole. Therefore,

generalization of the findings beyond the study area should be done with caution.

CONCLUSION

Result from this research work indicate that the average minimum departure waiting time values at route 2 for the all days are between 45 to 50 minutes, while the average optimum departure waiting time at the route 6 was 144 to 153 minutes.

RECOMMENDATIONS

- i. Commercial vehicle operators, both private and public, should be educated on the advantages of adopting the Intelligent Transport System (ITS) subsystem of APTS to achieve the goals of APTS in Minna metropolis.
- ii. Commuters should be adequately informed about the developed website for its effective use and to enable them appraise its efficiency.
- iii. Seminars and workshops should be organized to encourage and provide incentives for the pilot implementation of projects using APTS technology in various localities and under different conditions so as to promote the adoption and sustainable use of such systems in Nigeria.

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