A Multimodal Traveller Information System using both Web-Based Design Program and Traffic Analysis for Akure Metropolis

Olumuyiwa S. Aderinola, Abdulrahman A. Laoye and Adebayo I. Akinade

Abstract—A Traveller’s Information System integrated with traffic condition which can provide vital information to the users of the system is such a powerful tool in transportation planning. In this study, web-based multimodal advanced traveller information system was developed, which supplies information to trip makers within Akure metropolis and major cities with similar traffic condition. Traffic count was also taken on five roads which most of the transportation company’s vehicle ply so as to check for the traffic condition of the roads. The system provides information such as the available route from the origin of the traveller to his or her destination, the travel time, distance of each route, closest facilities like hotels, hospitals, airline services, airport terminal, departure time, departure time, arrival time and fare. The traffic count carried out revealed that Oyemekun road has the highest volume of traffic followed by Akure-Ado road while FUTA North gate road gives the least volume of traffic. The reason for the highest volume of traffic recorded at Oyemekun road is as a result of it location close to the CBD (Central Business District) while the lowest volume of traffic recorded for FUTA North gate is as a result of it location almost at the outskirt of the town. The web-based multi-modal traveller’s information system developed will help trip makers in Akure metropolis minimize the cost of their trips, by reducing travel time, energy consumption, and transport fare. Travellers are advised to embark on their journey earlier than the peak periods so as to avoid delay.

Index Terms—FUTA North Gate, Multimodal, Oyemekun Road, Traveller’s Information System, Web-Based.

I. INTRODUCTION

According to [1], Advanced Traveller Information System (ATIS) is one of the most widely used Intelligent Transportation System (ITS). ATIS implements a wide range of technologies, such as Internet web sites, telephones, cellular phones, television and radio to assist travellers and drivers in making informed decisions regarding trip departures, optimum routes, and available modes of travel. ATIS provides both pre-trip and en-route information to the users, both of which offer distinctive advantages. The transportation challenges experienced in most Nigerian urban centers include traffic congestion, inadequate provision of carriers for commuters in quantity and timeliness, poor traffic management, poor condition of roads, attitudinal behaviour of drivers. This situation calls for a very strong push by relevant stakeholders in the transportation sector to enhance the service performance of transportation facilities using ATIS [2]. The unavailability of detailed and explicit information on the available routes and their conditions with respect to traffic, road blockage/diversion, ongoing construction, maintenance and/or rehabilitation works and other necessary details worthy of knowledge (like rise in cost of public transportation and expected weather condition) for adequate trip preparation have caused unnecessary delays, extra cost and even at times jeopardized the safety of the traveller especially when he or she is using that route or transportation system for the very first time [3].

Ref. [4] developed a GIS based automatic transit traveller information system (ATTIS). The system was based on the idea to provide the users optimal trip option with least travel time between the traveller’s origin and destination, including walking, waiting, transfer, and in-vehicle time based on their origins, destinations, and bus schedules and/or real-time information of bus locations. Reference [5] gave an ATIS based on the web service and wireless communication technologies and in order to make the data more reliable and useful for the commuters, the methods of lost data reconstruction and travel time prediction were also proposed and examined in the study. An interpolation method was used for the lost data construction based on the periodical behaviour of the traffic. Ref. [3] developed a similar system using web and wireless communication technologies. Reference [6] presented an overview of a web based ATIS for developing countries keeping in mind that local traffic, roadway, signalization, demographic, topological, and social conditions in developing countries are quite different from those in developed countries. This was a three tier architecture system consisting of presentation tier, application tier and data tier. Ref. [7] gave a systematic overview of a GIS system that can be used for structuring, storing and dissemination of transit information on transit networks of Metropolitan Cities in India which was capable of handling real-time information. The system is also based on similar three tier architecture.

The unavailability of adequate transit or traveller information on the route or transportation system a traveller intends to use may lead to improper planning for the trip and could also cause unease or anxiety on the traveller as he or she is not sure of the sequential proceedings of the transportation system he/she is using. Also, the unavailability of this (traveller/transit) information could also militate against or sometimes even make it impossible

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for a traveller to make proper comparison between the transportation modes/systems consequently the best choice for the required speed, comfort, safety and (minimum) cost may not be made. Customers tend to shy away from the use and requisition of preferential treats that would soothe their desired comfort and pleasure and the use of public transportation in general due to the time consuming and stressful processes that are involved [8, 9]. This research therefore integrates a web based traveller information system with the traffic condition of Akure Metropolis so as to provide descriptive and prescriptive information to the users to improve their travel experience.

II. BRIEF DESCRIPTION OF THE STUDY AREA

Akure is the capital of Ondo State in Nigeria located within Latitude 7°25’N and Longitude 5°19’E. It has a population of about 484,798 according to 2006 population census [10]. The projection for the year 2020 put the city population at 571,740 with a growth rate of about 3.5 percent per annum [11]. The transportation system in Akure started receiving due prominence shortly after 1976 when the city became the seat of Government as various activities of trade and commerce, educational institutions, religious activities and so on commenced. New roads were therefore constructed new and old ones were rehabilitated [12]. Road transportation in Akure covers most part of the country as major roads linking other cities and states are generally good [11]. Fig. 1 depicts the various road networks in the metropolis with some other features like buildings. Generally, transportation system and fares in Akure can be concluded to be organized and cheap when relatively compared with other city transportation system.

III. MATERIALS AND METHODS

In designing the web-based multimodal traveller’s information system for the study area, data on the intra-states transportation system were obtained from five bus stations and Akure commercial airport using questionnaires. These data obtained were regarded as primary data and they were used as fundamental tools in developing a web program system for travellers in the study area. Computer programming codes termed HTML were written and imputed into the system as raw data. Other programming languages that can be used include JavaScript, JavaScript Object Notation (JSON), Asynchronous JavaScript and XML (AJAX), Cascading Style Sheets (CSS3), Visual Studio Code (VS CODE), MySQL DB, Hypertext preprocessor (PHP), JQuery and Cascaded Style Sheet (CSS3). The HTML and JAVASCRIPT codes used in this research are given under the supplementary material. Traffic analysis were carried out on five selected roads to determine the most congested routes and the least congested for effective decision to be taken by travellers.

Program Operation

There are steps involved in operating the website developed. The interface of the system is well-defined with the following menu; origin, destination, render route on map, list of hotel, list of hospital, list of airline services, restaurant, parking, automated teller machines, banks, churches, mosque and list of bus stop. The user can visit the link at http://akuretravellersinfo.xyz.

IV. RESULTS AND DISCUSSION

The results show the display information of the Akure Travellers Information System developed from the computer programming codes. Some of the interfaces generated are presented in Fig.s 2 to 7. For the input design, the origin and destination task bars are displayed so as to allow the system provide travellers the opportunity to select their origin and destination. These are shown in Fig.s 2 and 3 while for the output design, the route, direction description, airline services, bus stops, commercial centres and religious centres are displayed. Fig.s 2 to 6 show their interfaces generated.

![Generated Interface Showing Selected Origin](image1)

![Generated Interface Showing Selected Destination](image2)

Fig. 2. Generated Interface Showing Selected Origin

Fig. 3. Generated Interface Showing Selected Destination
After selecting your origin and destination, the system displaces the route needed by a user to reach his or her destination. The direction description interface describes the turning, travel time, distance and routes which can be used by user to get from their origin to their destination safely. Fig. 5 shows the direction description interface while Fig. 6 shows the airline interface.

Table I presents the two Airline services operational in Akure airport, their terminal, departure time, arrival time and fares.

**TABLE I: AIRPORT TRANSPORT SERVICE TERMINAL, DEPARTURE TIME, ARRIVAL TIME AND FARE**

| S/N | Roads       | Dest. | Fare       | EDT  | LDT  | ETA  |
|-----|-------------|-------|------------|------|------|------|
| 1   | Peace       | Lagos | ₦27,300 -  | 12:20pm | 12:30pm | 12:55pm |
|     | Airlines    |       | ₦29,000    |      |      |      |
| 2   | Overland    | Abuja | ₦38,500 -  | 11:30am | 11:45am | 12:30pm |
|     | Airways     |       | ₦40,500    |      |      |      |

N.B.: Dest. is destination, AST is Airline Service Terminal, EDT is Earliest departure time, LDT is Late departure time, ETA is estimated time of arrival.

Parking interface provides travellers with the available five interstate parks within Akure with their address of the park, places they go to, their various fares, travel time, arrival and departure time. This is shown in Fig. 7.

**A. Maintaining the system**

The advanced Traveller’s Information System can be maintained through frequent hosting annually. Though the system is flexible enough to entertain any future amendment which might be required when the need arise, it requires that it being commercialized in order to sustain it functionality.

**B. Traffic analysis**

The result of the overall traffic composition carried out on each of the five major routes in the study area for a period of one week, in order to check for the capacity of the road is given in Table II. Table II and Fig. 8 show that the traffic composition along Oyemekun road and Akure-Ado road is very high while the area with least traffic composition is the FUTA North gate road.

**TABLE II: TRAFFIC COMPOSITION ALONG THE SELECTED ROADS**

| S/N | Roads       | Mon  | Tue  | Wed  | Thur | Fri  | Sat  | Sun  | Total  |
|-----|-------------|------|------|------|------|------|------|------|--------|
| 1   | O           | 5272 | 4877 | 4218 | 4102 | 3482 | 3080 | 4216 | 29247  |
| 2   | A-On        | 4027 | 3730 | 3856 | 3328 | 3673 | 3116 | 2975 | 24705  |
| 3   | A-Ow        | 3301 | 2856 | 2877 | 2883 | 3466 | 3553 | 3172 | 22108  |
| 4   | FNG         | 3694 | 3181 | 2533 | 2362 | 2779 | 3643 | 3396 | 1588   |
| 5   | A-Ad        | 4638 | 4360 | 4119 | 4134 | 3466 | 3553 | 4375 | 3731   |

N.B.: O, A-On, A-Ow, FNG and A-Ad are Oyemekun, Akure-Ondo, Akure-Owo, FUTA North gate and Akure-Ado roads respectively.

This result arises from the fact that the two routes (Oyemekun road and Akure-Ado road) are located close to the central business district and other commercial centres in the study area while FUTA North gate road provide exit.
from the study area to another city entirely. It was also observed that morning peak period (7:00 am-8:00 am) gives the most prominent and highest result in all the days.

V. CONCLUSION

This study has developed a web-based multi-modal traveller’s information system which will help trip makers in Akure metropolis to minimize the cost of their trips by reducing travel time, energy consumption, and transport fare. It also provides a mean through which users can get adequate route guidance within Akure. The traffic composition of some selected roads in the study area was also documented with Oyemekun road taking the lead while FUTA north gate road take the least position. Travellers are therefore advised to embark on their journey earlier than the peak periods so as to avoid delay.

APPENDIX

Computer program for the web-based multimodal traveller’s information system

HTML Code

```html
<!DOCTYPE html>
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initial-scale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>Document</title>
<link href="https://fonts.googleapis.com/icon?family=Material+Icons" rel="stylesheet">
<link rel="stylesheet" href="css/app.css">
<link rel="stylesheet" href="css/materialize.min.css">
</head>
<body>

<header>
  <nav>
    <link rel="stylesheet" href="css/brand-logo.css">
    <!-- Akure Travellers Information system -->
    <a href="#!" data-panel="mobile-demo" class="sidenav-trigger">Menu</a>
    <!-- Menu for navigation links -->
    <ul class="sidenav" id="mobile-demo">
      <li><a href="index.html">Home</a></li>
      <li><a href="login.html">Admin</a></li>
      <li><a href="bookings.html">Booking</a></li>
      <li><a href="#!">Contact</a></li>
    </ul>
  </nav>
</header>

<main>
  <div class="container">
    <div class="row">
      <div class="col s12 m8 l12 zero-space">
        <div class="input-field col s12">
          <input id="from" type="text" class="black-text materialize-input">
          <label for="from">From</label>
        </div>
        <div class="input-field col s12">
          <input id="to" type="text" class="black-text materialize-input">
          <label for="to">To</label>
        </div>
        <div class="input-field col s12">
          <input type="radio" name="type" id="changemode-driving" checked />
          <span>Driving</span>
        </div>
        <div class="input-field col s12">
          <input type="radio" name="type" id="changemode-walking" />
          <span>Walking</span>
        </div>
        <div class="input-field col s12">
          <input type="radio" name="type" id="changemode-transit" />
          <span>Transit</span>
        </div>
        <div class="input-field col s12">
          <input type="radio" name="type" id="changemode-mobil" />
          <span>Mobile</span>
        </div>
      </div>
      <div class="col s6">
        <div class="input-field col s12">
          <input id="mode-transportation" type="text" class="black-text materialize-input">
          <label for="mode-transportation">Mode</label>
        </div>
        <select id="transportation-mode" class="materialize-select" name="transportation-mode">
          <option value="" selected >Select mode</option>
          <option value="driving">Driving</option>
          <option value="walking">Walking</option>
          <option value="transit">Transit</option>
          <option value="mobil">Mobile</option>
        </select>
        <label for="transportation-mode">Mode</label>
      </div>
    </div>
  </div>
</main>
</body>
</html>
```

JAVASCRIPT Code

```javascript
(function(){
  'use strict';
  var map, iconAkure = 'images/pin.png';
  initLocation = { lat: 7.250771, lng: 5.210266 }; // akure
  var originPlaceId, destinationPlaceId, travelMode, directionsService, directionsDisplay, var app = function(){
    var self = this;
    return {
      initMap: function(){
        //
        // zoomControl: boolean,
        // mapTypeControl: boolean,
        // scaleControl: boolean,
        // streetViewControl: boolean,
        // rotateControl: boolean,
        // fullscreenControl: boolean
        // }
        var init = setInterval(function(){
          var app = function()
```
The authors wish to express their profound gratitude to the entire staff of Department of Civil and Environmental Engineering, Federal University of Technology, Akure, Nigeria and research department, Tetragrammaton construction company Limited, Ibadan, Nigeria for their immense support during data collection and processing.

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CONFLICT OF INTEREST STATEMENT

On behalf of all authors, I, O. S. Aderinola, is hereby
confirming that that there is no conflict of interest.

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