A Multimedia GIS Database for Planning Management and Promotion of Sustainable Tourism Industry in Nigeria

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Keywords: Development, Multimedia, GIS, Database, Management, Tourism.

ABSTRACT

Nigeria's quest for the diversification of her mono cultural economy by promoting tourism industry since 1991 was discussed. This has resulted in the establishment of the National Tourism Development Corporation, the creation of a Federal Ministry of Culture and Tourism and a Tourism Council with the President of Nigeria as chairman.
The objective of the research is to develop a multimedia GIS Database for Tourism industry in Nigeria as a perceived technical solution to the problem of planning, management and promotion of both domestic and international tourism in Nigeria. The greatest challenge is to develop a multimedia GIS Database by integrating different types of data such as **text data, graphical data** (maps, graphs), **picture data** (still and moving pictures) and **sound data** (voice and music). Hand held GPS was used to locate tourism sites and for geo-referencing digital maps of Nigeria. Tourism spatial and attribute data gathered were classified into three categories – **Cultural, Ecological**, and **Modern-day** tourism. A relational GIS database was created using Arc View 3.3/ArcGIS8.1
Multimedia Studio Pro 5 Video Edition and Microsoft Windows media Player were used in this research project to convert recorded sound to wave files and scanned images, text and pictures into video clips. Video clips directly recorded by the Digital Video Camera were downloaded using ULEAD Video Studio DV 5.0 with a Fire wire 1394 adapter, into the Pentium IV 2.4GHz computer equipped with a Microphone where the relational database was created. Video clips with sound were compressed and hot-linked with the other types of data in Arc View GIS environment using Arc View Script files thereby creating a multimedia GIS database for tourism in Nigeria. Still pictures from a Digital Camera after conversion to video clips were similarly hot-linked with Nigeria's tourism maps including those of 36 states and Abuja Federal Capital Territory(FCT). Other special features of the GIS database include generation of tabular and spatial queries about tourism industry in Nigeria and spatial network queries for determining best routes to tourism sites and hotels
A comparison of the capabilities of Arc View 3.3 and ArcGIS 8.1 for the development of a Multimedia database was made. An **internet access** to **electronic tourism Atlas** and **user-friendly multimedia GIS database** as well as to **Tourism Catalogue** which are produced from this research project, constitutes a veritable tool for the **development**, **management** and **promotion** of Tourism Industry in Nigeria.

1. INTRODUCTION

1.1 Development Of Tourism

The Nigerian Government in her quest to diversify her mono-cultural economy, which is heavily dependent on petroleum export, has decided to take some bold measures to develop and promote travel and tourism. These measures include the adoption of the National Tourism Policy (NTP) in 1990, the birth of the Nigerian Tourism Development Corporation (NTDC) in 1992, the founding of the National Institute for Hospitality and Tourism (NIHOTOUR), in Baganda, Kano, and the National travel Bureau (NTB), a tour operating company of NTDC, (NTDC (2001)), the adoption of a Tourism Master Plan and the inauguration of the National Tourism Council with the President as chairman. The aims of these measures can be summarized as follows:
- To make Nigeria the ultimate Tourism destination in Africa and
- To make Tourism one of the greatest foreign exchange earners in an oil dependent economy.

2. OBJECTIVE

With a population of about 120million people, about 300 ethnic groups, a vast land of approximately 1million sq km, a beautiful coastland of about 835km, and a rich diversity of cultural and ecological tourism resources, Nigeria appears destined to be indeed the "Giant" of Africa as far as tourism is concerned. The big question is why is it that Nigeria like some other African countries is yet to develop her full potential in the tourism industry? Dondo et. al. (2004), observed that the success of tourism in any country depends on the ability of that country to develop, manage an market tourism facilities and activities .The objective of this research is to develop a multimedia GIS database for Tourism industry as a perceived technical solution to the problem of planning, management and promotion of both domestic and international tourism in Nigeria. Such a database constitutes the basis for promoting efficient and productive multimedia spatial information services by private and government tourism agents all over the country. The greatest challenges in developing a multimedia GIS is to integrate different types of data such as text data, graphical data (maps, graphs), pictures data (still and moving Pictures) and sound data (voice and music), thus creating in some cases, a multiple representation for the same data. The combination of the Multimedia and GIS technologies will certainly build a powerful distributed tourism information system which is bound to improve the services offered in the tourism industry in Nigeria (Benabdallah and Soltane, (2001))

3. METHODOLOGY

3.1 Data Acquisition, Hardware and Software

Tourism data in form of text and maps about the 36 states of Nigeria and the Federal Capital Territory (FCT), Abuja were collected from a variety of sources including existing Maps, Plans,

Charts, Newspapers, Magazines, Brochures, Travel Guides, Textbooks, and Websites of the states and Federal governments, Ministries and Agencies and by ground survey.

3.1.1 Hardware

The following hardware were used in acquiring and processing tourism data.

- Handheld Global Positioning System (GPS) was used for establishing the planimetric coordinates of Tourism sites and features and also for georeferencing and updating existing maps.
- Pentium PC IV,2.4GHz,120G HD,1G RAM with full multimedia capability for storing and processing text, graphical, sound and image data.
- A0 digitizer for digitizing some existing maps in preparation for their conversion into digital format as alternative to on-screen digitisation.
- A0 and A3 Scanners for scanning other available maps in preparation for on-screen digitisation.
- Digital Camera (Sony) for capturing digital still pictures of tourist sites
- Digital Video Camera (Sony Digitals) for recording video clips of tourist sites and features and tourism activities
- A0 and A3 Printers/Plotters online with Pentium IV for printing tourism maps of the states, FCT and some state capitals
- Microphone for recording sound into the computers to describe images, maps, tourism activities and also as a narration for tourism documentary.

All the listed hardware except the scanners and A0 digitizers were acquired through the University of Lagos Central Research Fund provided by the Nigerian University Commission.

3.1.2 Software

The research project required a number of software because of the Multimedia nature of the data requirement.

- Microsoft Word served as medium for processing, editing and display of textural information/attribute data about tourism
- Microsoft Excel was used to key in relational tabular data and were saved in Dbase IV format
- AutoCAD Release 14 was employed for on-screen digitizing of all scanned maps
- Ulead Video DV 5.0 with a Fire wire 1394 adapter was used in downloading video clips recorded by the Digital Video Camera into Pentium PC IV.
- Ulead Video Studio Pro 5 which has the capability of converting recorded sound to wave files which are later converted into AVI files and also of converting scanned images and photographs into Video Clips , was also used.
- Microsoft Window Media Player played the Video Clips

- User designed script in Java format was written to hotlink wave files and video clips to Arc View environment
- ArcView3.1 and ArcGIS 8.1 were the only GIS processing software. All text, tabular, map and image data were exported into the ArcView environment.
- Arc View 3.1 and Microsoft Windows TM explorer were used to facilitate a seamless integration and manipulation of all the multimedia GIS data types into a Multimedia Database for Tourism. ArcGIS 8.1 was used instead of ArcView 3.1 for the purpose of comparison only.

3.2 Classification of Tourism Data

In this research, tourism data were acquired under the following three categories, which constitute the major layers in the designed GIS database:

- **Traditional Cultural Tourism:** Museum, art galleries, cultural, religious and national festivals, historical monuments, and features such as sites and buildings, arts and crafts.
- **Ecological Tourism:** Geological / geophysical /geomorphologic features, (mountains, waters, falls and springs) beaches, national parks, games/forest reserves, botanical / zoological gardens etc.
- **Notable modern Features and Facilities:** Hydroelectric power dams, oil rigs, sporting and health facilities and other notable engineering structures travel and accommodation Facilities, Tourism Centres and agents, and other related data to tourism (see fig 1).

The data obtained under the three classes were related to their geographical locations in their states and local government areas of Nigeria and a tabular relational Database was created showing tourism attractions from all the states, their local governments, the type and class of Tourism attraction, (Ayeni et. al. (2001),(2003)).

3.3 Multimedia GIS Database

There are two basic approaches to creating a Multimedia GIS Database viz “Multimedia in GIS” approach in contrast to “GIS in Multimedia” Schneider (1999).Since it is more difficult to integrate GIS functions into Multimedia, the first approach was adopted for this research and also because of its simplicity and user-friendly nature. The procedure for developing a Multimedia GIS Database partially described in section 3.1 may be summarized as follows:

- Conversion of Analogue map to Digital format using the methods described in section 3.1
- Creation of Relational tabular database with their attributes and of the topology from the vector data
- Creation of GIS database for Tourism with capabilities for queries in the ArcView GIS environment.
- Conversion of recorded digital photographs to video clips and sound to wave files and to AVI format as described in section 3.12.
- Hot-linking Multimedia files created above to corresponding files in the GIS database.

All the constituents of the multimedia GIS database are depicted in fig. 2.It is obvious that the presence of still and moving pictures and sound data are the major elements that distinguish generic GIS from Multimedia GIS.

4 RESULTS AND DISCUSSION

4.1 Results

The main result of the research project is the development of a Multimedia GIS database for Tourism Industry which contains a record of Ecological, Cultural and Modern Tourist Features and activities, and their geographical locations in Nigeria (Fig3). According to Benabdallah et al (2001), one of the problems often encountered in the tourism industry is lack of data and a quick update and maintenance of available data.

The multimedia database provides a credible and pragmatic solution to this problem because a GIS database is a well structured and intelligent electronic database which can be easily updated, refreshed and secured with a good database management system. In a multimedia GIS database, tourism features and activities are not only recorded in form of a text, but also in form of maps, pictures, movies, music and voice data.
Fig.3 illustrates the various outputs, which were generated from the multimedia GIS database for tourism Industry in Nigeria. The outputs include the following:

- Tourist maps, graphics, pictures and video clips about tourism interests, which were printed on an online A3 Cannon Printer or A0 HP 800 Design Jet printer.
- Multimedia Atlas of Tourism in Nigeria in analogue and digital format.
- Directory of Tourism in showing titles and the sources of major tourist information and publications on tourism in Nigeria.
- Catalogue of Tourism for Nigeria in Digital and Analogue format, which is a systematic arrangement of tourist interests in Nigeria with detailed description of these interests.

4.1.1 Comparison of two GIS Software for Multimedia GIS Capability

Considerable effort was made in this research to compare the functional capabilities between Arc View 3.1 and ArcGIS 8.1, two popular software produced by ESRI with substantial price differential, for the development of a Multimedia GIS database for Tourism. The following are the findings:

- The two software are good for building a Multimedia GIS database,
- ArcGIS 8.1 is faster and more versatile and more flexible particularly in hot linking of text, sound, and image data with a digital map in a Multimedia GIS database.

- For handling video data hot linking in Arc View 3.1,it is necessary to write a script specifying the location of the software to be used to play the video file, while in ArcGIS 8.1,only the name of the file needs to be specified with the file extension (.avi, .mpg,etc)
- ArcGIS 8.1 has a greater scope on the SQL Query Builder Dialog box than Arc View 3.1.the corresponding scope of result is also greater in ArcGIS 8.1 than in Arc View 3.1.
-The output in terms of maps produced are the same .However, the extra cost for ArcGIS 8.1 can be said to be justified, in terms of flexibility, versatility and speed.

4.2 Discussion

A user-friendly Multimedia GIS database, developed in this research constitutes a great resource for producing various tourist maps of Nigeria and for educational institutions offering courses in tourism in Nigeria.

4.2.1 GIS and Hot-linking/Hyperlink

The location of tourist features and activities are very important to a tourist. Figs 4a, 4b, 4c show three maps of Nigeria, depicting the location of some ecological, cultural and modern tourist attractions. Fig 4d a Composite Tourism Map of Nigeria was also generated by automation integrating figs 4a, 4b and 4c with a command within the limitations of scale.

Tourism maps for all the 36 States of Nigeria, and Abuja/Federal Capital Territory which have been hot linked to the composite map of Nigeria (Fig4d) can also be generated automatically .A click on any of the states or FCT opens up a wealth of tourism information and their locations. The information may also be tabular text, still picture, moving picture with graphics maps or sound about the state. A click on FCT in Fig 4d generates the tourist map depicted in Fig 5 and a click on fig5 generates Fig 5b. A click on any tourist interest on Abuja(fig.5b) will show a still picture or movie or any data which have been hot-linked to the tourist map. This feature is very important to a tourist who may wish to find Nigreia's tourist haven before visiting the country.

4.2.2 Spatial and Aspatial Queries

There are three types of queries allowed by the multimedia GIS databases:one of them is called Tabular Queries. For example a tourist may want to ask some questions about hotel facilities in Abuja e.g. how many hotels have more than 500 rooms in Abuja? How many hotels are available in Abuja? Fig 6a:1 and Fig 6a:2 provide answer from Relational Tabular Database to the two questions.
The second type of query is spatial in which spatial computations of distance will be done before providing an answer. For example the tourist may wish to know how many hotels are within 25km radius of the International Airport in Abuja.
Fig 6b provides the answer to this question. The number and type of queries are limitless.

A Query may be multimedia in nature. For example, the user or tourist may ask to see NNPC building in Abuja. The result of this query is displayed in Fig 6c. The Query feature of a GIS database may assist a tourist to plan his trip a priori, based on facts and figures, or visualisation obtained through answers to these and other types of queries.

4.2.3 GIS and Network Analysis

A network is a set of interconnected linear features such as roads, railways, power lines, sewage pipes and telephone lines, which constitute modern social infrastructure. Network analysis is a tool for analysing the structure of a network. Since there is a spatial dimension to linear features, their network described by arc-node topology can be incorporated into a GIS database. There are three principal types of network analysis viz Network Tracing; (tracing a particular path through the networks), Network Routing; (determining the optimal path along a linear network) and Network Allocation, Turk etc. al (2004).In order to illustrate network Tracing and Network Routing application, an arc-node topology was established for the road network of Abuja the Federal Capital Territory of Nigeria using vector data model and incorporated into the Abuja FCT GIS database developed in this research. ArcView Network Analyst from ESRI, was used to make a network analysis query showing the best route with shortest distance from Arterial roads to existing Hotels within Abuja Metropolis.
Fig 6d displays the result as the road in redline with a description of the direction and a total distance of 17518.86meters.As with the spatial query discussed in the previous section, the number of Network Analysis is limitless. For example a user or tourist can do proximity and nearest neighbour analysis queries such as -what is the shortest road from a hotel to a tourist site? Network Analysis was incorporated into the Multimedia GIS database for other towns and cities of Nigeria such as Lagos (Lagos state), Owerri (Imo state), Ibadan (Oyo state), Abeokuta (Ogun state) and Port Harcourt (Rivers state).

5. OTHER APPLICATIONS OF MULTIMEDIA GIS DATABASE

5.1 Multimedia GIS and Sustainable Tourism Development

Sustainable Tourism Development has in recent times become an increasingly popular subject. The World Tourism Organisation (WTO, 2001) defined it as a tourism development that meets the “needs of the present tourists and the host regions while protecting and enhancing opportunities for the future” and also leads to “the management of all tourism resources in such a way that economic, social and aesthetic needs can be fulfilled while maintaining cultural integrity, essential ecological processes, biological diversity and life support system” (Liu, 2003). It has been demonstrated in the previous section that multimedia GIS tourism database meets the needs of tourists and the host regions by the use of spatial and aspatial multimedia and network analysis queries in providing qualitative and quantitative information about locations of

tourism sites, best or nearest hotels, optimum plan for sight seeing and shortest route in getting to tourism destination (Figs 4d, 6a-6d),
Besides a multimedia GIS database can be easily updated and expanded to meet the future needs of both tourist and the host regions. According to Bahaire and Elliott-White (1999) GIS "can be regarded as providing a tool box of techniques and technologies of wide applicability to the achievement of sustainable tourism development" A multimedia GIS provides a bigger "tool box" with the addition and integration of pictures, sound, map and text data into a conventional GIS database. Such a database constitutes the basis for providing efficient and productive multimedia spatial information service by both private and government tourism agents all over Nigeria.

5.2 Multimedia GIS and Sustainable Tourism Planning

Dondo et.al. (2004) referred to Fridgen's(1991) American model for the success of any tourism business as dependent on three factors-**tourism planning**, **tourism development** and **tourism marketing**. A multimedia GIS for tourism industry in Nigeria serves as a tourism resource data inventory which is fundamental for sustainable planning of tourism. Besides GIS functionality spatial analysis, spatial modelling, database integration, queries and network analysis can be used to obtain useful information for sustainable tourism planning. Examples of such useful information are:
-Identification of the most suitable locations for ecotourism tourism development
-Measurement of tourism impacts.
-Analysis of relationships associated with tourism resources. Bahaire et.al. (1999) have produced a table linking functional capabilities of GIS with tourism planning applications.
Perhaps one of the greatest tools provided by GIS for sustainable tourism planning is the map in its various types and scale-whether digital or analogue, small or large scale, topographic or cadastral. Giles(2003) has identified three types of maps for tourism planning-Tourist resource maps, tourist use maps and tourism capability maps which can easily be generated from any multimedia GIS database with appropriate attribute data.GIS database basically constitutes a decision support system for tourism development control and direction. A map is the most important ingredient for sustainable planning.
As part of this research GIS was used to determine the best locations for recreational facilities in Ikorodu Local Government of Lagos State, Nigeria using spatial analysis techniques such as facility, overlay and site suitability analyses, buffering and visualisation .
Behaire et.al. al (1999) contains a literature review of various applications of GIS to tourism and recreational planning in the U.K, Canada and the USA.
In Africa, modest attempts have been made to introduce GIS to tourism planning and management for example in Zimbabwe and Ghana as reported by Dondo et. al.(2004) and Longmakey (2004) respectively, although the potential of Multimedia GIS has not been fully explored. These examples serve as inspiration for the application of Multimedia GIS to Tourism planning and development in Nigeria.

6. GIS AND TOURISM PROMOTION

While it is expedient that Nigeria has an up-to-date Multimedia GIS database which contains per excellence a wealth of information about our cultural and ecological diversity, the database should not be an end by itself. The need for efficient marketing of tourism facilities activities and destinations is one of the most important ingredients of success in tourism.
Without an efficient promotion and marketing strategy, Nigeria will continue to sit "on a potential tourism gold mine" (Nkonu, 2006). The first step towards effective promotion and market strategies is to computerize the tourism industry in Nigeria. This will involve the training of officials of the Ministries and Agents(private and public) in charge of tourism in computer technology and a few key staff in GIS and Multimedia technologies. The second step towards promotion and marketing strategy for tourism is to make the user-friendly Multimedia GIS Tourism Database and it's by products- the Digital Tourism Atlas, and the Digital Tourism Catalogue,Tourism Directory, and their analogue versions developed in this research, available to all stakeholders and players in the Tourism Industry in Nigeria. It should be noted that the Tourism Atlas and the Tourism Catalogue are more user-friendly than the Database. The stakeholders should include the Federal and State Ministries and Agencies in charge of Culture and Tourism, the Agencies in charge of tourism at the Local Government level, and members of the following associations: the Federation of Tourism Association of Nigeria, Tours and Travel Operators, and the Association of Hospitality and Hotels Operators. Based on visualisation and evaluation of the tourism sites assembled in the Multimedia spatial database, Nigerian Tourism Sites should be classified as **Local**, **State**, **National** and actual or potential **International** (**UNECO**) **Heritage Sites** using **well defined criteria.**

7. CONCLUSIONS

The following conclusions are made as a result of this research:

- **A multimedia GIS database contains unparallel reservoir of multi-dimensional inventory of tourism data which can easily and quickly be updated.**
- **Multimedia GIS Tourism database and its by-products such as Tourists Maps**, **Tourism Directory, Tourism Atlas**, and **Tourism Catalogue**, can be used **to create awareness of the rich cultural and ecological tourism potentials of Nigeria.**
- **The Multimedia GIS Database can be used by a tourist or tourist agents for optimum planning of tours by the use of queries and network analysis.**
- **The multimedia spatial database is indeed a veritable and powerful tool for planning, management and promotion of sustainable tourism industry in Nigeria.**
- **A world-wide internet access to the multimedia spatial database** and its by-products and the distribution of the same to tourism agencies and stakeholders and to Nigeria's Embassies and High Commissions world-wide will certainly enhance access to tourism information, will rich out to both domestic and foreign tourism market in a new way to make the tourism industry a veritable foreign exchange earner, probably next to Petroleum. **Multimedia GIS**

database for tourism is also a veritable tool for attracting indigenous and foreign investors to contribute to the economical development of Nigeria, apart from making access to tourism information and destination easy.

8. RECOMMENDATIONS

As stated before, developing a Multimedia GIS database for Tourism Industry should not be an end in itself , but a means to an end. Its establishment in any developing country like Nigeria by any tourism agency (public or private) should be regarded as a catalyst for sustainable tourism development. The following recommendations therefore covers the way forward after the establishment of a Multimedia GIS database for Tourism in a developing country like Nigeria.

- Government agencies, ministries, parastatals and private commissions and all other stakeholders in the Tourism Industry should as a matter of urgency, computerise tourism operations. We are living in a Digital Age in which it is hard to survive without expertise in Information and Communication Technology (ICT).This will enable stakeholders in this vital industry to save large volumes of tourism data in an organised manner, such that storage, correction, update and retrieval of such data can be performed with ease. It will also make it easy to transmit tourism information to the public at large. Complusory computer and communication education for the staff employed to manage tourism data will enable such staff, to understand how to use Multimedia GIS Database developed for Tourism.

- The Multimedia Spatial Tourism Database, Tourism Atlas, Tourism Catalogue and Tourism Directory developed in this research should be posted on the websites, and also installed in the computers of both Government and private agencies dealing directly or indirectly with tourism for a world-wide outreach to domestic and foreign tourists who may wish to have information about tourist interests in the country. Tourism trade has become a world-wide phenomenon and a country should make use of web technologies for marketing its culture and natural ecological endowment and modernisation. The analogue versions of the Tourism Atlas, Tourism Catalogue and Tourism Directory resource should be conspicuously displayed in the offices and libraries of these tourist agencies. Tourism facility operators should be free to print many brochures and pamphlets from the GIS database.

- A National Workshop on how to operate, apply and update the multimedia GIS Database for tourism industry should be organised for all tourism stakeholders operating in the country. In return trained stakeholders are expected to update the aspects of the tourism database in their state, or locality and make the information available to the public via the internet.

- University Degree and Post Graduate courses should be established in the country so as to promote tourism education and research. Most developing countries are in dire need for professionalisation of personnel in the tourism industries. Only a few of the tourism facilities

operators are well trained. There are too many areas of the tourism which await research particularly in multimedia GIS operations. For example a three dimensional (3-D) GIS can be employed to build a 3-D virtual tourism guide to a city, Jasnoch (Jan 2001); GIS needs to be applied for a better management of national parks in most developing countries; most of these countries do not have information about the number tourists visiting tourist sites and which countries they are from. The curriculum of the university degrees should incorporate the applications of ICT, GIS, Multimedia and Remote Sensing technologies to tourism industry. The **Multimedia GIS Database** and its by products –**Multimedia Tourism Atlas**, **Tourism Catalogue** and the **Digital Tourism Directory**-provide a good **Educational Resource Base** for University degree programmes and research in tourism.

- There are specialised aspects of modern tourism which are sometimes neglected in Nigeria and in other developing countries such as **Sport Tourism**, **Health Tourism**, **Education and Technological Tourism** (out sourcing).These modern tourism features have greater potential as foreign exchange earners than some classical tourism destinations. The problem of security must be fully addressed in developing countries so as to assure tourists of safety of life and property. A good transport system by air, rail, road and water is also vital in promoting tourism. Nigeria has 36 states plus Abuja FCT and 572 local government councils which are rich in tourism; it is therefore not possible to get enough funding to cover the whole of Nigeria in details during this research. There is therefore a need for more funding to complete in details the survey of some states of Nigeria.

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REFERENCES

1. Ayeni O.O., Ikwuemesi G. (2002) “Developing A GIS Database for Tourism in Nigeria” Proceedings 4th international conference, African Association of Remote Sensing of the environment.
2. Ayeni O.O., Saka D.N. and Yakubu,N (2003) “Application of Multimedia GIS to Tourism in Abuja and Environs” Proceedings 1st AGA/Conference of Geoinformation Society of Nigeria, Nov. 2003.
3. Bahaire, Tim and Elliot-White, M (1999): “Application of Geographical Information Systems (GIS) in Sustainable Tourism Planning: A Review”. Journal of Sustainable Tourism Vol 7 No. 2, P. 159-174

4. Bar, H.R and Sieber R. (1999). “Towards High Standard Interactive Atlases: The GIS and Multimedia Cartography Approach”; Proceedings, International Cartographic Conference, Ottawa, Canada.
5. Benabdullah, S and Soltane, K.B (2001):”The Importance of Multimedia and GIS Technologies in the Tourism Industry”.ERCIM Website file://MyDocuments\Multimedia\Tourism 10/13/2001
6. Dondo, Ch. Bhunu, S.T Rivet U. (2004): “GIS in Tourism: A Zimbabwean Perspective. Inter-Archives of Photogrammetry and Remote Sensing and Special Services. Vol XXXIV, Part 6W6 pp 197-200
7. Fridgen I.D (1991): “Dimension of Tourism, A H and M A, Education Institute, East Lansing, MI
8. Giles, W (2003): “GIS Application in Tourism Planning” Seminar Paper. www.cnc.bc.ca/gis/Documents/340Tourism Termpaper.pdf
9. Jasnoch, U et al (2001): “Virtual Tourist Guide: Advanced Applications of 3D GIS Oriented towards a Broad Consumer Market”. GIM International June 2001, pp 39-41.
10. Liu Z (2003), “Sustainable Tourism development: A Critique, Journal of Sustainable Tourism” Vol 11:6 pp 459-475
11. Longmatey D, Amoaka-Atta S and Piah B.K (2001): “Management and promotion of Tourism in Ghana: A GIS Approach”, ESRI Users Conference. http://www.sis.esri.com/library/userconf
12. Nigeria Tourism Development Corporation (NTDC) (2001). Nigerian Tourism Volume 1, No. 2.
13. Nkonu N (2006) Tourism- “Potentially Nigeria’s Biggest Forex Earner” Vanguard Newspaper, http://vanguardngr.com/articles/2002/features/tourism/tt220012006.html
14. Schneider, B. (1999) “Integration of Analytical GIS functions in Multimedia Atlas Information Systems”, Proceedings, 19th International Conference of ICA, Ottawa.
15. Tazim, B, Iamal (2004): “Virtue Ethics and Sustainable Tourism Pedagogy: Phronasis, Principles and Practice”. Journal of Sustainable Tourism, Vol 12:6, pp 530-545
16. Turk, T, Gumusay, M.U (2004): “GIS Design and Application for Tourism, Inter-Archives of Photogrammetry and Remote Sensing and Special Services. Vol XXXIV, Part 6W6
17. Zhou, W and Blais J.A.C (1998) “On the Design and IMPLMENTATION OF A Multimedia Based GIS: Issues, Solutions and Outlook” Department of Geomatics Engineering,University of Calgary,Canada
18. WTO (2001): “The Concept of Sustainable Tourism”.http://www.world-tourism.org/sustainable/concepts.htm

Figure 1: CLASSIFICATION OF TOURISM

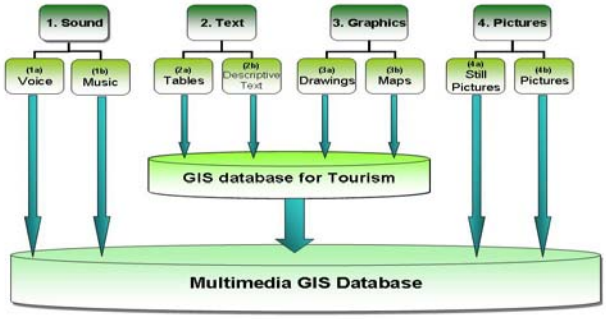


Figure 2: MULTIMEDIA IN GIS DATABASE

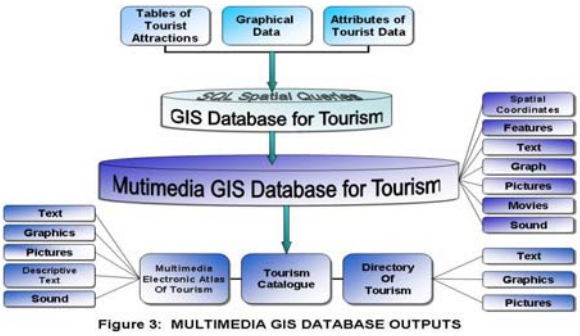


Figure 3: MULTIMEDIA GIS DATABASE OUTPUTS

Fig 4a: Map of Nigeria Showing Ecological Tourist Attractions

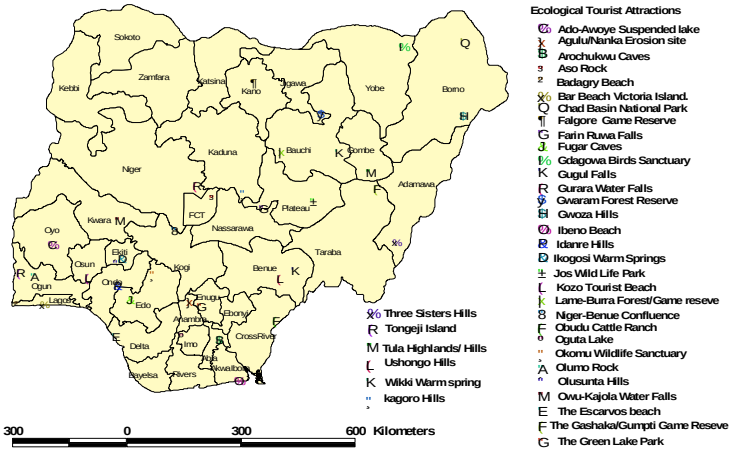


Fig 4b: Map of Nigeria Showing Cultural Tourist Attractions

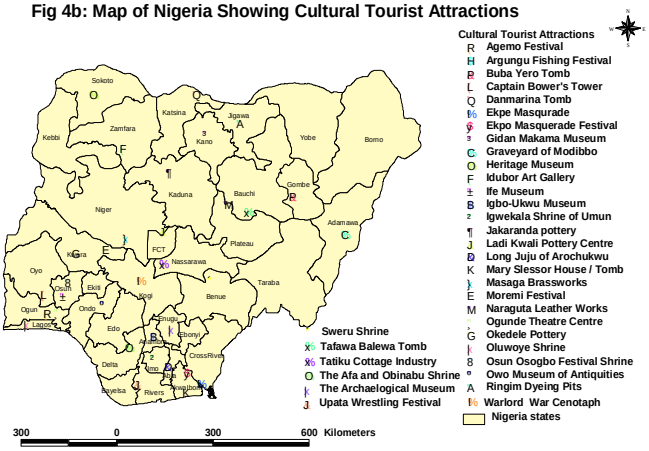


Fig 4c: Map of Nigeria Showing Modern Tourist Attractions

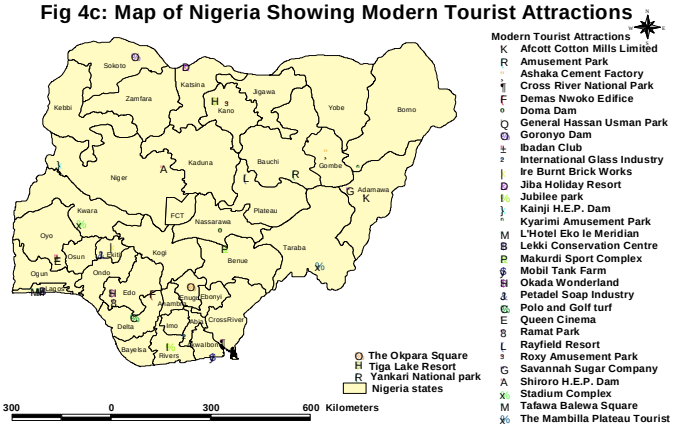


Fig 4d: Map of Nigeria Showing Some Tourist Attractions in States of Nigeria and the Federal Capital Territory

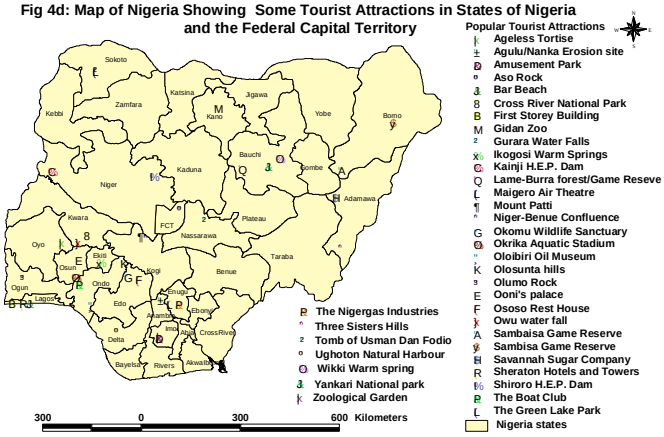


Fig 5: Map Showing Tourist Attraction of Interest in the Federal Capital Territory (FCT)

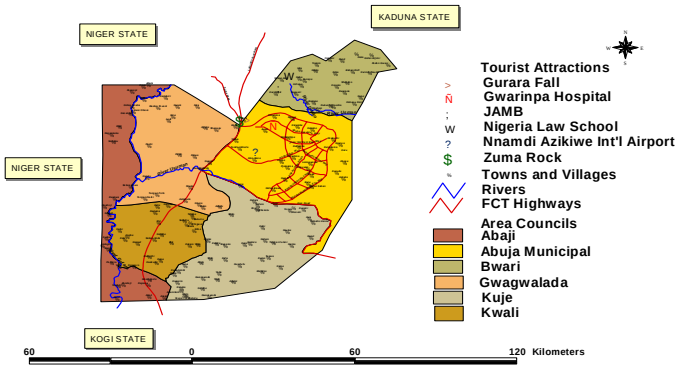


Fig 5b: Map Showing Tourist attractions and Sight Seeing Places in the Abuja Metropolis

Fig 6a: 1) Aspatial Query on Abuja showing how many Hotels have rooms more than 500?

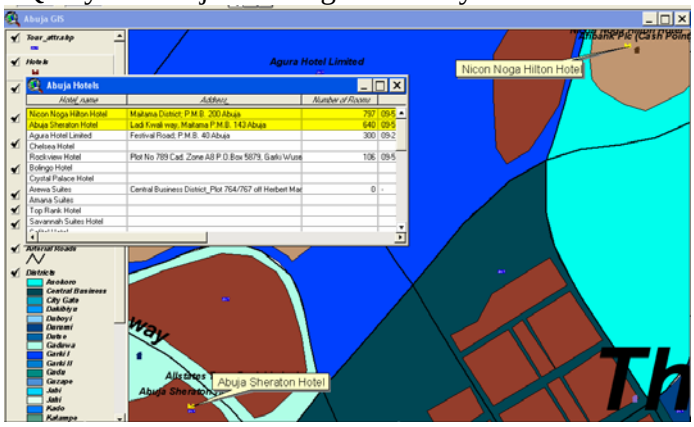


Fig 6a:2) Aspatial Query on Abuja Showing the number of Hotels within the Abuja Municipal Area Council.

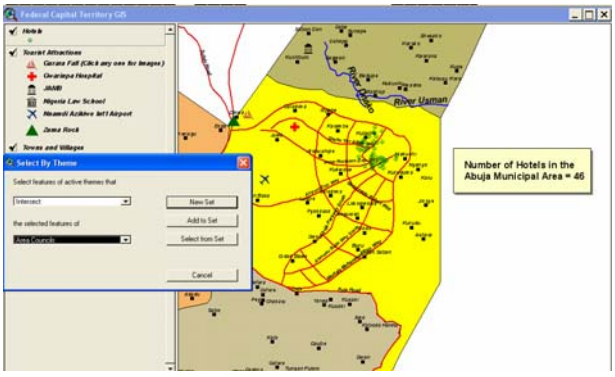


Fig 6b: Spatial Query on Abuja showing the number of Hotels in Abuja Municipal Area that are within 25km to the Nnamdi Azikwe International Airport.

Fig 6c: Multimedia Query on Abuja showing NNPC Headquarters

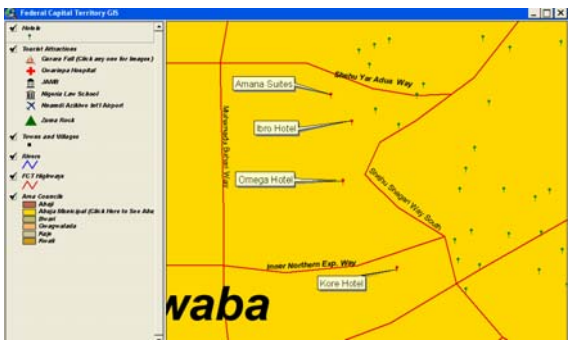
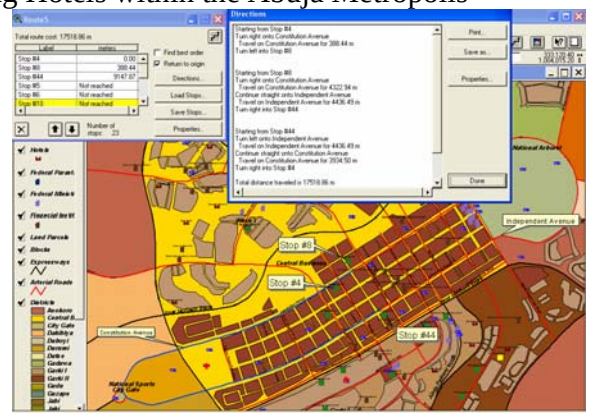


Fig 6d: Spatial Network Analysis Query showing the Best route and Shortest distance from Arterial Roads to Existing Hotels within the Abuja Metropolis



BIOGRAPHICAL NOTES

Prof. Olubodun Ayeni (1941-): A Professor of Surveying. He was engaged as a Senior Lecturer in 1979 at the University of Lagos, Nigeria. He became a Professor in 1983.Between 1985 and 1991,he was the Director of RECTAS (Ile-Ife, Nigeria), and has since been back to the University where he lectures at the Department of Surveying and Geoinformatics.He has many published works in Remote Sensing, Photogrammetry, Geographic Information systems, and Adjustment Computation & Statistical Analysis of Survey Data. He has also been involved in numerous international projects.
Professor Ayeni is a winner of International Prizes and Awards such as; Talbert Abraham Award (ASPRS, 1983), Instrumentation of America (1975),and Edward Dolezal Award (ISPRS,1996).He is presently a Council member of the Surveyor's Registration Council of Nigeria (SURCON) and the President of the Geoinformation Society of Nigeria (GEOSON) and Council member of AARSE.

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