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Locational Analysis Of Facilities In Nnamdi Azikiwe University Awka, Nigeria Using Gis Approach

Emengini, E.J.[1]
NNAMDI AZIKIWE UNIVERSITY AWKA, ANAMBRA STATE, NIGERIA
Ojiako, J.C.[2]
NNAMDI AZIKIWE UNIVERSITY AWKA, ANAMBRA STATE, NIGERIA
Igbokwe, E.C.[3]
NNAMDI AZIKIWE UNIVERSITY AWKA, ANAMBRA STATE, NIGERIA
Akinnibosun, J.B.[4]
NNAMDI AZIKIWE UNIVERSITY AWKA, ANAMBRA STATE, NIGERIA

ABSTRACT-**The significance of location and space cannot be over emphasized in business operation, educational institutions, history, and geographical reality. The ease of access to different Departments in any institution will determine the rate at which transaction will be carried out in the place. This makes application of GIS in Location Analysis of Facilities an absolute necessity if the System of the institution is to be economically feasible. Therefore the aim of this project is to apply GIS in the Locational Analysis of Facilities in Nnamdi Azikiwe University Awka. The base map of the entire campus was acquired alongside with the coordinates of new structures. Handheld GPS was used to obtain the ground coordinates of the existing structures on the base map. The base map was scanned and digitized and the coordinates of the new structures were plotted using ArcGIS 10.1, with this an accurate depiction of existing structures and the road networks were obtained. Data about these structures were gathered with which a database was created for relating the facilities location with the road network. Queries were performed to determine the location of certain structure of interest in relation with the route network. Network Analysis techniques were used to generate optimal route management from school functional main gate to other locations within the campus. Recommendations were made that this kind of project be undertaken by the department of Surveying and Geoinformatics at least every five years to update on new structural developments and that the Map produced from this research work be deployed on the University website, to aid any prospective student who visited the site to have a better knowledge of the University.**

1. INTRODUCTION

A University is a school of Universal learning which means that it is the assemblage of different people from different parts in one spot for every departments of knowledge. In another word university consist of teachers, learners, management, marketers, cleaners, drivers, and all other member of the community. In short a university is a model of human society. It is a community in which new people enter on daily basis.

Nnamdi Azikiwe University (NAU) is an academic institution of higher education and research which grants academic degrees in a variety of subjects and provide both undergraduate and postgraduate education. NAU is an educational institution dedicated to education and research, which grants academic degrees. She is one of the twenty-five federal universities which are accredited and overseen by the National Universities Commission with the Awka Campus sited in Awka, Anambra State, in the southeastern part of Nigeria, and has a second campus at Nnewi. Nnamdi Azikiwe University was named after a great Nigerian Leader Dr. Nnamdi Azikiwe the former President The institution was formerly University before conversion into Federal University in 1992. This University has so many departments and comprises of students and lecturers from different part of the world. She is a growing institution, therefore there is need to understand its road network and facility location.

Road networking is concerned with issues of land use, environments, economics and demography. According to (Bailey, et al 2008), transportation route is part of distinct development pattern or road network and mostly described by regular street patterns as an indispensable factor of human existence, development and civilization. Road networks are observed in terms of its components of accessibility, connectivity, and traffic density, level of service, compactness, and density of particular roads (Idaa, 2014).

The need of the University is a geospatial analysis of the structural location in relation to the road network of the University. Almost everyone that comes to the University for first time encountered the problem of spending precious time before locating where they are going. It is a general knowledge that time is an essential commodity that should not be wasted, thus there is a need to provide solution on this problem of locating places within the university. Therefore this research was designed to take up the challenge of produce digital map of the University and create a database containing all the existing structure and finding their proximity and their spatial relationship with other points such as the main gate, the Ifite gate, the administration building, the banks and other departments using GIS approach.

II. STUDY AREA

The study area is Nnamdi Azikiwe University Awka, part of the urban area of Awka the capital city of Anambra state (figure 1.1). It is located within the tropical rainforest zone of West Africa between latitudes 6°06´N and 6°16´N and longitude 7°01´E and 7°10´E (Idaa, 2014).

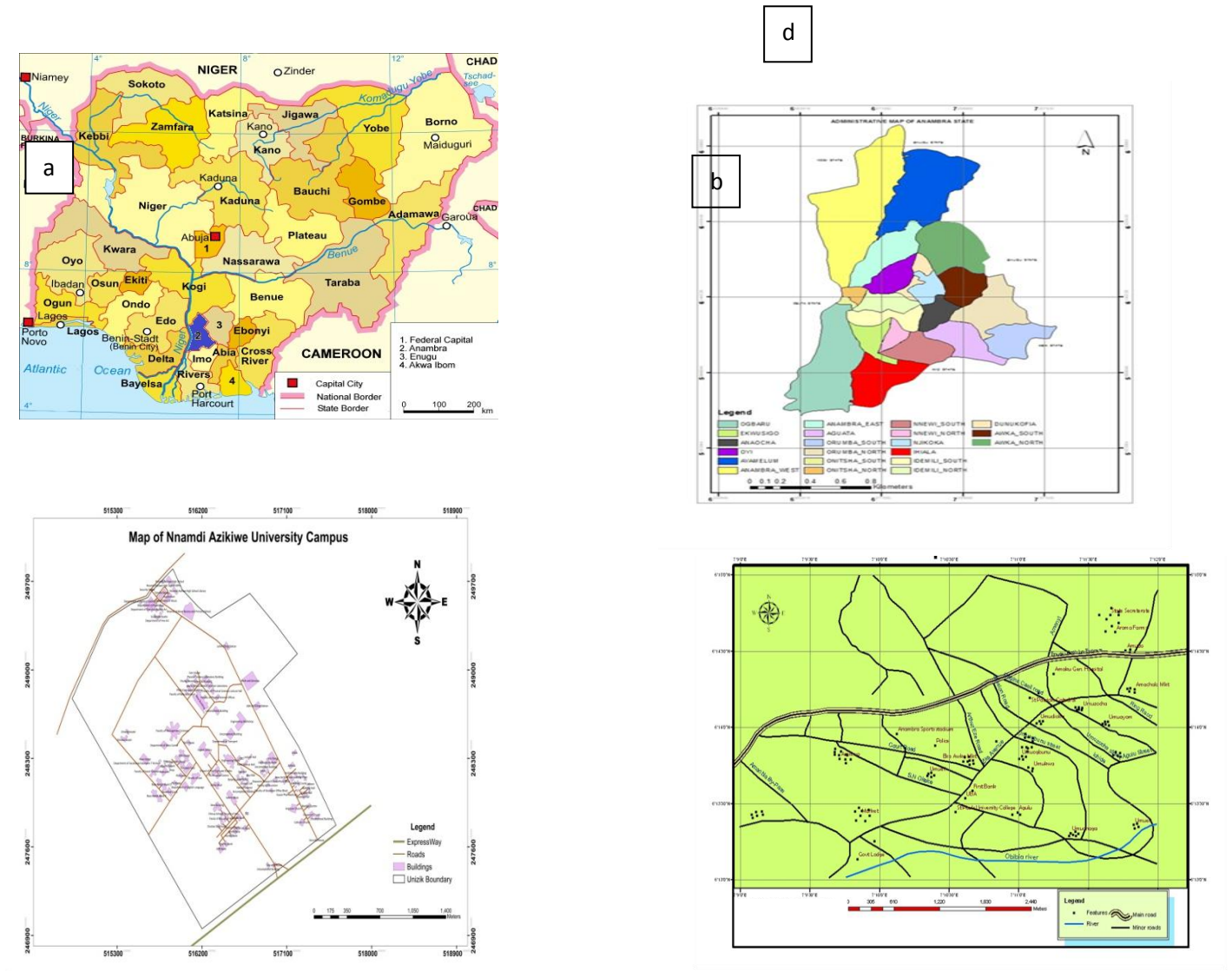

Figure 1.1: (a) Map of Nigeria showing Anambra State, (b) Map of Anambra State showing Awka South L.G.A, (c) Map of Awka South L.G.A. showing Azikiwe University, Awka, (d) Map of Nnamdi Azikiwe University, Awka

III. DATA AND METHODS

This chapter deals with the methodology adopted in the execution of this research project. (See figure 3.1). The methodology is subdivided into various steps starting with the data used in the execution of this project which included both primary and secondary data and instruments used were of software and hardware components. The methodology adopted for this study involves following major steps: data acquisition, data processing, GIS Analysis and data presentation as shown in figure 4.1.

B. DATA REQUIREMENT

i. The data used for the study include the administrative map of Anambra state showing local government Awka south local government and the map showing the study area.

ii. Awka South Local Government Area map showing road networks and constituent district.

iii. The data on use of each structural feature on the campus. The data was collected over in order to feed in information for spatial query.

iv. Picture recordings for multimedia effect using digital cameras,

v. Materials available in academic journals conference papers, relevant text and internet document for literature review.

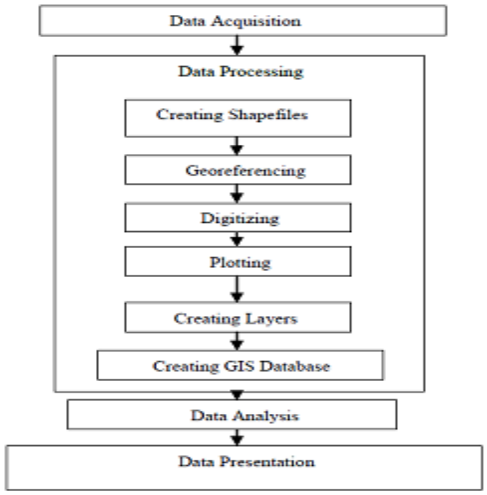

Figure 3.1: Methodology adopted for the study.Source: Modified from Idaa, (2014)

A. DATA ACQUISITION

Acquisition of Primary Data

The primary data were obtained through field observation. These include;

i) Positions of sites of interest using hand held GPS to acquire the coordinates, the name and type of roads as well as the junctions.

ii) Attribute data includes non-spatial descriptive information of the buildings in the sites of interest.

iii) Direct photo coverage of the structures in the site of interest using canon shot A420 digital camera.

C. DATA PROCESSING

The stage of processing of GIS data involved the following steps:

A. Database modeling:

The three phases of database modeling include: conceptual, logical and physical modeling phases. (Kufoniyi,1998)

i. Conceptual Database Modeling Phase: This is a representation of human conceptualizing of reality of the entire information content of the database. Here decision on how the view of reality was presented in a simplified manner and to the satisfaction of the information requirement of the project must be made.

ii. Logical Database Modeling Phase**:** This is a representation of the conceptualization of the reality in a data structure that can be implemented by the computer software to be used. In this study, the relational data model was used. In a relational data model, data are separated into tables, and each table contains fields. Fields are objects (attributes of entities). The entities and attributes are translated

iv) Attribute data: this includes non-spatial description information of every structure of interest

Acquisition of Secondary Database

The secondary databases needed were obtained from digitalization of a reliable map such as:

i) Administrative map of Anambra state showing local government boundaries,

ii) Nnamdi Azikiwe University campus area map showing boundary, road networks of streets and different blocks on the campus.

iii) Materials available in academic journals, conferment papers, relevant texts and documents.

into a geo-relational data structure and the following relations are derived

iii. Physical Modeling Phase: This is the phase where the data structure is translated into built-in data of the chosen software. Since GIS software dictates most of the physical database design activities these days.

D. GIS ANALYSIS

In order to obtain the best answers from the database system several types of queries were framed and executed. A query is a precise definition of what to select or retrieve from the database and also enables specification of which field is wanted in what order fields should appear.

IV. RESULTS AND DISCUSIONS

The aim of GIS project is to aid decision making, through the use of certain parameters set by the user. Such decisions were made via the use of certain parameters set by the researchers and these set parameters are dependent on the information inputted in the attribute of each layer.

This stage of analysis is known as the stage of data query; the analyses were done one after the other as follows.

The first analysis was to query the data bank containing all the buildings in Nnamdi Azikiwe University Campus, Awka present in the Map. The data bank was created in such a way that when the layer containing them is clicked on, it will display all the
Information regarding the buildings (attribute table), but when a particular building is clicked only the information pertaining to that building will be displayed.
This Query is done by right clicking the layer and opening the attribute table and hyperlinked the images. The data available includes: Names, Locations, Status and images.
Also to use the identifier button to query, click on the identifier icon and then click on the feature of interest in the map. When this is done, a dialogue box appears which will contain all the information captured about that feature. Both spatial and aspatial (non-spatial) query can be carried out in these research work. This is because all the data required for both queries are available, that is spatial query entails query with location and aspatail query involves querying with attribute and they are available.
For Location of features present based on their coordinates and to show the images. Figure 4.1 shows the location of Admin block and its hyperlinked image in the Map for easy identification

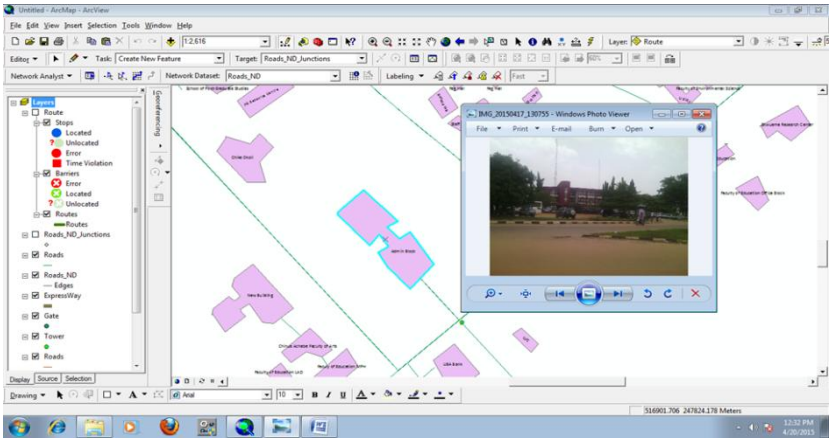

Figure 4.1: Image Hyperlink of Administrative block

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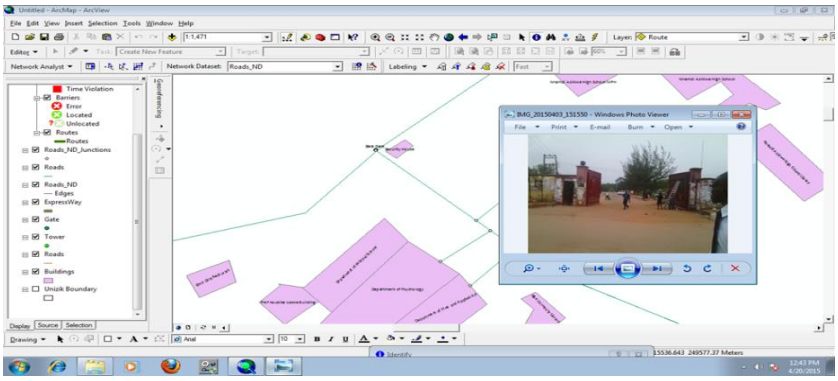

Figure 4.2: Image Hyperlink of University Library

4.2 show the location of the Library in the map based on its coordinates.

Another location of feature present in the map based on its coordinates and the image was displayed in figure 4.3 which shows the location of the Ifite Gate (at Garba square) and its image in the Map for easy identification
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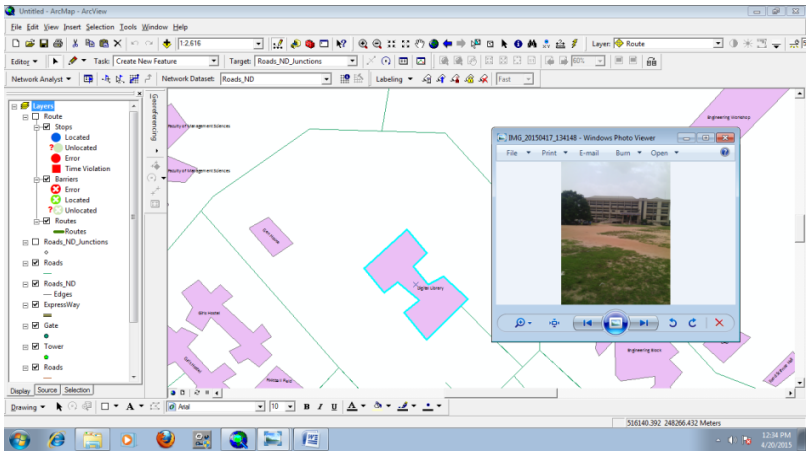

Figure 4.3: Image Hyperlink of Ifite Gate

Another location of feature present in the map based on its coordinates and the image was displayed in figure 4.4 which shows the location of the NAU Gate (leading to Enugu - Onisha Express way) and its image in the Map for easy identification

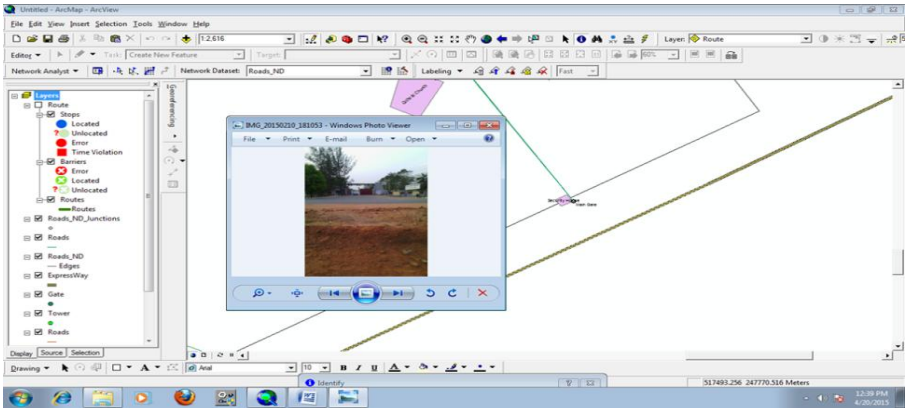

Figure 4.4: Image Hyperlink of NAU Gate (leading express way)

Another location of feature present in the map based on its coordinates and the image was displayed in figure 4.5 which shows the location of First Bank (one of the Banks within the University) and its image in the Map for easy identification

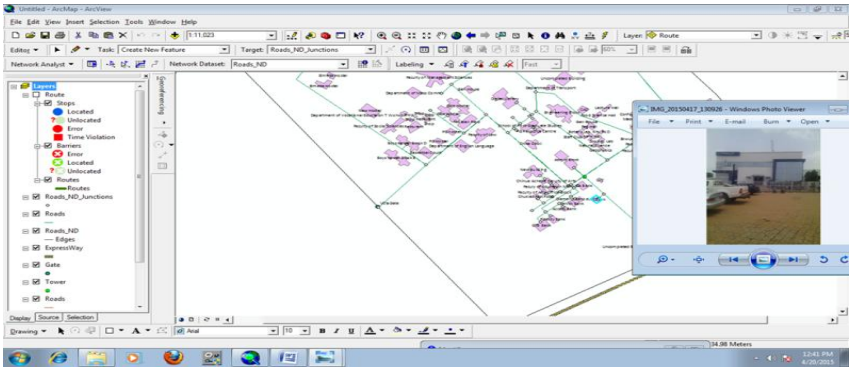

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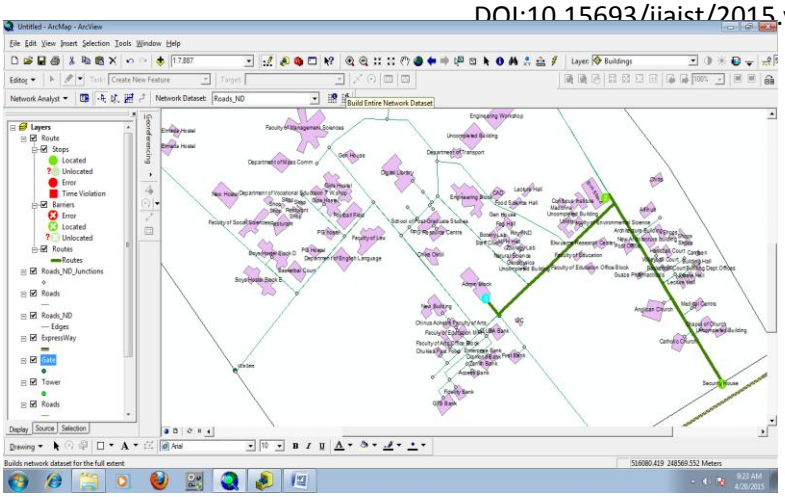
Figure 4.5: Image Hyperlink of First Bank (One of the Banks in the University)



Another analysis was framed to determine the route to the Administrative Block using network analyst tool in ArcGIS 10.1.As shown below in figure 4.6

Figure 4.6: Route from Gate to through Bus Stand to the Admin block

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Another analysis was carried out on the route moving from the School Gate to Church (Chapel of Glory).
The first is the Gate while the second point is at the Entrance of the Church. The routing is shown in Figure 4.7

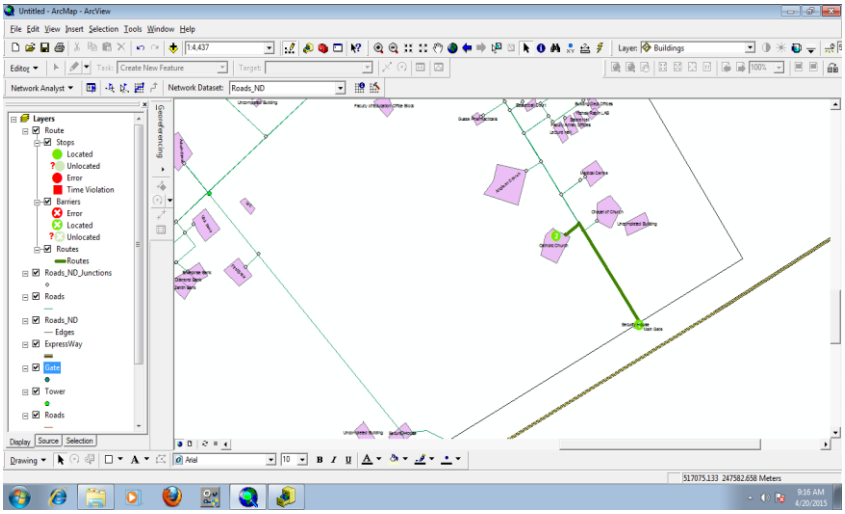


Fig. 4.7: Route from Gate to Chapel of Glory Church.

Route analysis was also carried out on the route moving from the School Gate to The University Medical Centre.
The first is the Gate while the second point is at the Entrance of the Church. The routing is shown in Figure 4.8

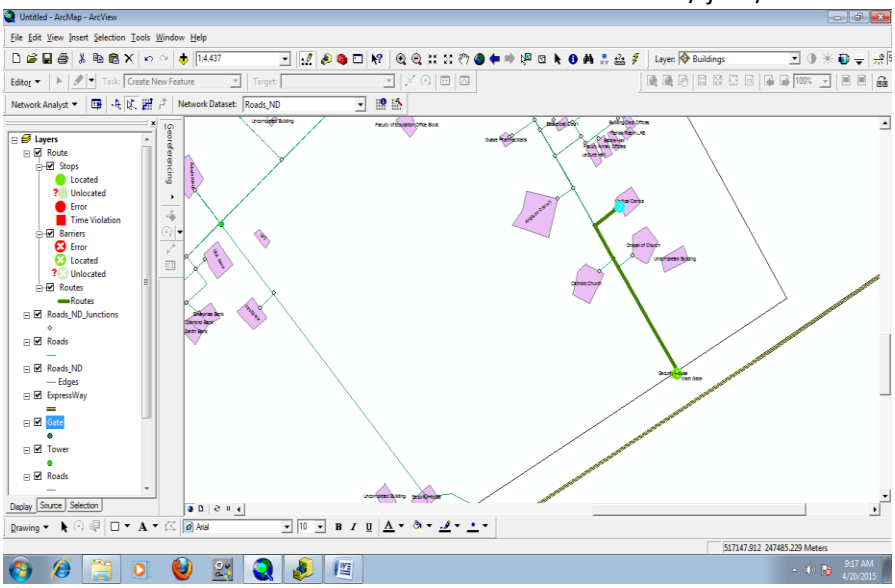


Figure 4.8: Route from Gate to NAU Medical Centre.

Another route analysis was also carried out on the route moving from the School Gate to The Gauze Pharmacy Store. The first is the Gate while the second point is at the Gauze Pharmacy Store. The routing is shown in Figure 4.9

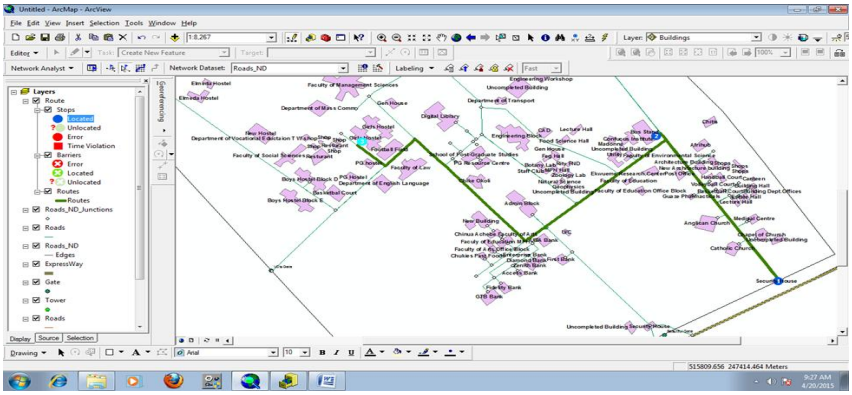


Figure 4.9: Route from Gate to Gauze Pharmacy Store.

Another route analysis was carried out to determine the route moving from the School Gate to Bus Stand. The first is the Gate while the second point is at the Bus Stand. The routing is shown in Figure 4.10

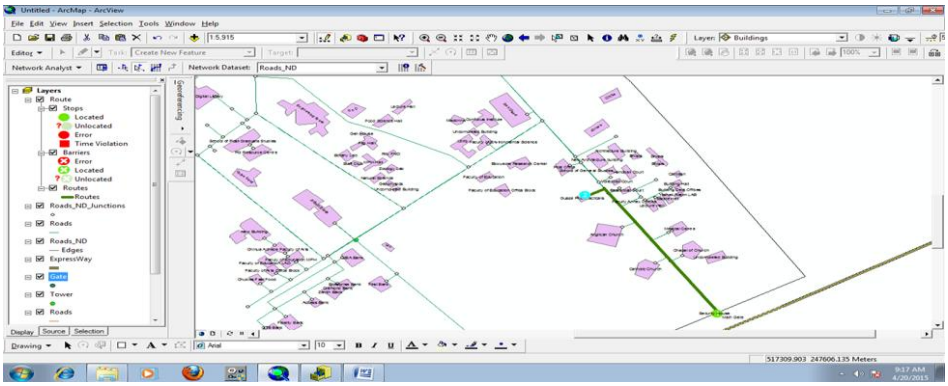
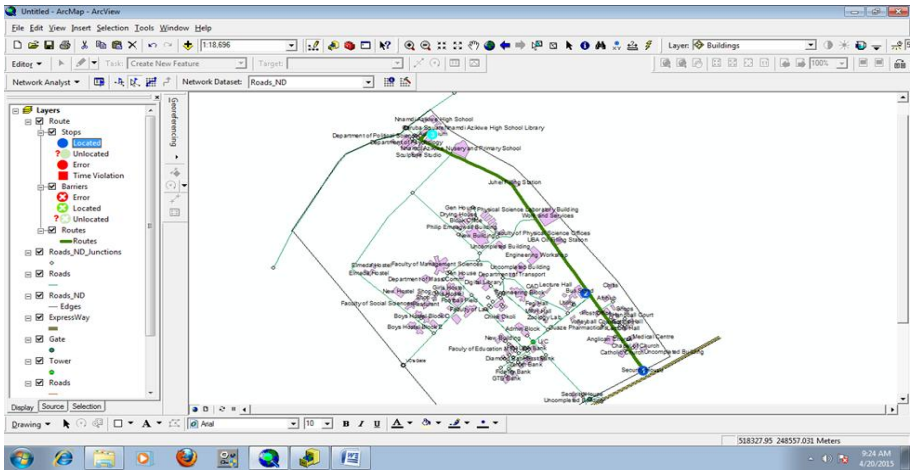


Figure 4.10: Route from Gate to Bus Stand.

Another route analysis was carried out to determine the route moving from Bus Stand to the University Auditorium.



The first is the Bus stand while the second point is at the Auditorium. The routing is shown in Figure 4.11

Figure 4.11: Route to Auditorium from Bus Stand.

Another analysis was carried out on the route moving from Bus Stand to the University Library.
The first is the Bus stand while the second point is at the University Library. The routing is shown in Figure 5.12

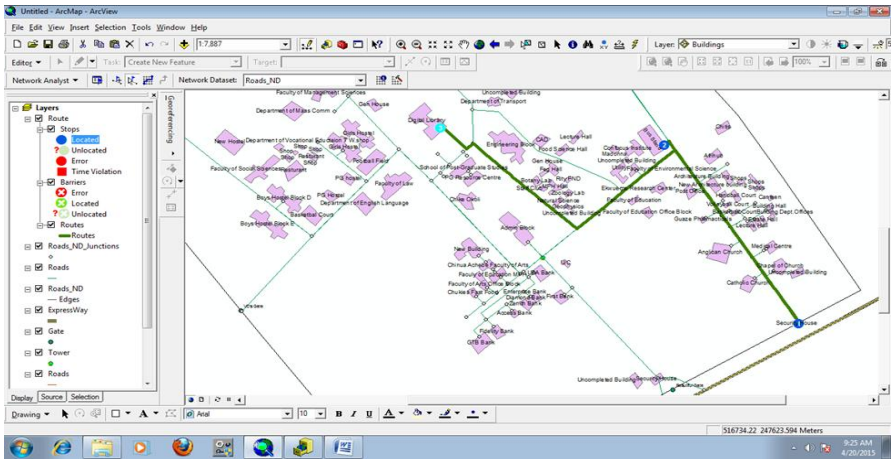


Figure 4.12: Route to library from Bus Stand.

Another analysis was carried out on the route moving from Bus Stand to the Female Hostel (assume the fresher is female).
The first is the Bus Stand while the second point is at the Female Hostel. The routing is shown in Figure 4.13

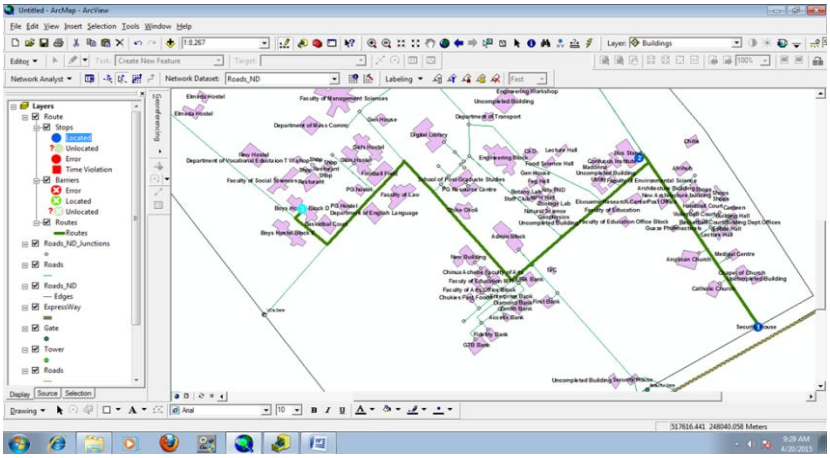


Figure 4.13: Route to Female Hostel from Bus Stand (assuming the fresher is female).

Another analysis was carried out on the route moving from Bus Stand to the Boy Hostel (assume the fresher is female). The first is the Bus Stand while the second point is at the Boy Hostel. The routing is shown in Figure 5.14

V. Discussion of Results

This queries where performed with the aim of helping a fresher who might be coming to the University for the first time. Either male or female the first set of queries show the images as well as the locations of some important places in the University such as the Administrative Block for registration, the Banks for payment of school fees, the two functional major gates to the University Campus and the University Library. The second sets of queries were on the route network analysis to various places within the campus. These queries were performed with the assumption that the first timer is a student newly admitted into the university.. With the richness of the database so many other queries can be performed based on the requirement of the user. Finally, apart from the digital Map a hardcopy map showing the whole NAU campus was produced as the final product of this project.

VI. CONCLUSION

GIS is a veritable tool for vital decision making in route network analysis, in surveying, and all line features such as pipeline, sewer lines and river can also be analyzed in the field of civil engineering. In this study query were performed with the developed database of the entire attribute about the road and buildings characteristic to obtain the outputs analysis. The query was made to get information about feature by this system. The route was analyzed by setting the origin and destination to point. Finding the best alternative route and determining the closest facilities and inquire information network feature. It is important to remember that the shortest route could not be the fastest route since travel times are always faster on the paved roads than on unpaved roads or roads under constructions, but sometimes factors like traffic congestion on major ways can make unpaved roads journeys faster. From the above study it is very clear the GIS is an effective tool in any discipline with relevance to space, it can be used to identify the best alternative route to any facility or destination and so on.

VII. RECOMMENDATIONS

As a result to the findings of this project the following recommendations were made:

i) That the University policy makers should adopt the use of GIS to handle the problem of road network and location of structural facilities within the campus by using the Campus Digital Map and GIS software to query for decision making, as this will ensure effectiveness in the institutional activities on daily basis, and help in time management.

ii) That this kind of project be undertaken by the department of Surveying and Geoinformatics at least every five years to update on new structural developments.

iii) That this particular research work be improved on to create a full administrative database for the University. In which all the information about each of these structured can be included in the database, and this database must be well managed.

iv) That the Map produced from this research work be deployed on the University website, to aid any prospective student who visited the site to have a better knowledge of the University.

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Author's Profile

Emengini, E.J., received B.Sc & M.Sc degree in Surveying and Geoinformatics from Nnamdi Azikiwe University Awka, Anambra State, Nigeria and Ph.D in Remote Sensing from Lancaster University UK in 2010. She is currently the Head of Surveying and Geoinformatics Department, Nnamdi Azikiwe University Awka, Anambra State, Nigeria. Her research interest includes Remote Sensing, Geographic information Systems, Digital Mapping