Geographic Information System Based Approach to Pre-Election Monitoring In Awka South Local Government Area of Anambra State, Nigeria

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Abstract— GIS based electoral system provides efficient database and also be useful to enhance officials to conduct and manage elections. This research is aimed at using Geographic Information System based approach to monitoring election in Awka South L.G.A of Anambra State. The methodology employed in this research involves conversion of analogue map into digital map (through the process of scanning), georeferencing and digitizing, updating the study road map using Google Earth image. Other processes includes: Plotting of coordinate points, Geo-database creation and queries generations. GIS based mapping is one of the best techniques of depicting spatial data, the location the polling unit was depicted and it was noticed that there are no polling units located at around/within Ngozika and Udoka Housing units.

Keywords— Election, Geographic Information System, Spatial Database.

I. INTRODUCTION

Democracy in Nigeria, especially the conduct of elections, has always been characterized by pessimism, uncertainty and fears for the safety of people's lives and properties; this is as a result of conflict ridden situations, which have historically featured in all elections conducted in Nigeria since the 1950s. Hence, issues surrounding the electioneering processes potentially relate to violence and violations of the rights of individuals. Thus, rather than serve as a means and a process of exercising legitimate political rights, elections in Nigeria have since independence, turned out to be a serious political liability; causing serious political turmoil and threatening the survival of corporate Nigeria (Abbass, 2008).

The use of GIS in elections can cover the whole elections cycle from boundary demarcations (polling units and area mapping) to the elections results transmission including results management and citizen participation. This research however focuses on the pre-election monitoring stage. GIS can enhance the accessibility of information from the boundaries to the location of polling stations thereby contributing to confidence in the electioneering process.

II. STUDY AREA

The study area is Awka South Local Government Area of Anambra State. Awka south is located at latitude 6°20'N and 6°33'N and Longitude 7°00'E and 7°15'E.

III. METHOD

The method used in this research including the data requirement, the overall methods, techniques, approaches and materials are presented in the following sub sections.

A. 3.1 Data Requirement and Sources

The data used for this study includes the following:

a. The administrative maps of Nigeria, Anambra state and Awka South Local government Area.

b. Road data of Awka south L.G.A. This was gotten from digitizing of analogue map collected from ministry of Lands and survey. And Google image (November 2015) of the study area downloaded from Google Earth Pro.

c. Polling unit Directory and Register for Awka south Local Government, this was sourced from the Independent National Electoral Commission (INEC) Anambra office.

d. Total number of registered voters in the different polling units. This was extracted from the polling Register collected from INEC office.

e. Location of polling units in Awka south LGA. Handheld GPS was used to collect the coordinates of the polling units.

f. Demographic data was sourced from the National Population Commission, Anambra office.

g. Other relevant data was sourced from statutory bodies where necessary.

B. Acquisition of Primary Datasets

The primary datasets used for this research work were obtained through field visits, these includes:

i. Positions or location of using polling units in Awka south LGA. Handheld GPS Garmin 76 was used to collect the coordinates of the polling units.

ii. Attribute data: This includes non spatial descriptive information of the location of polling unit.

iii. Pictures of sites of interest were captured using a digital camera.

C. Acquisition of Secondary Datasets

The secondary datasets was gotten from digitization of available map data and attribute data such as:

a. The administrative maps of Nigeria, Anambra state and Awka South Local government Area. These were sourced from Quantum GIS 1.8 Lisboa (tutorial pack).

h. Road data of Awka south L.G.A. This was gotten from digitizing of analogue map collected from ministry of Lands and survey. And Google image (November 2015) of the study area downloaded from Google Earth Pro.

b. Polling unit Directory for Awka south Local Government, this was sourced from the Independent National Electoral Commission (INEC) Anambra office.

c. Total number of registered voters in the different polling units. This was extracted from the Polling register collected from INEC office.

d. Demographic data was sourced from the National Population Commission, Anambra office.

D. 3.2 Data Processing

The methodology employed in this research involves conversion of analogue map into digital map, updating of Awka street map using Google Earth image, plotting of coordinate points of polling units, Geo-database creation and queries generations. First, the analogue map of Awka South was converted to digital through the process of scanning, georeferencing and digitizing. Subsequently the street map was updated from Google earth, the process of updating downloading the study area image from google earth using Google Earth Pro., georeferencing in ArcGIS 10.1 environment and digitizing. The coordinate points of polling units were plotted on the map, after which a robust geospatial database was created with the demographic and voter information. Consequently, the database was analysed and various queries generated for the research.

E. 3.3 DATABASE DESIGN

Database design is the process of producing a detailed data model of a database (Hernandez, 2012). The design phase consists of three levels (Kufoniyi, 1998):

a) Conceptual Design
b) Logical Design
c) Physical design

F. Conceptual Design

Conceptual design is the first step in database design where the contents of the intended database are identified and described. It deals with the identification of the basic terrain objects together with the spatial relationship that exist among them. It is human-oriented, often partially structured, model of selected objects and process that are though relevant to a particular problem domain. Conceptual design is carried out independent of the software and hardware that will be used to implement the database.

a. Logical Design

This is another stage of the database design in which all the real world entities conceptualized were modeled into the real world using logical design. It is the representation of the conceptual design to reflect the recording of the data in the computer system using a relational database management system (RDBMS) (Effiong and Alagbe, 2012). In this phase, the entities, their attributes and their relationships were represented in a single uniform manner inform of relation in such a way that would be no information loss and at the same time no unnecessary duplication of data.

b. Physical Design

This involves the translation of the real world entities into the computer compactable forms of the chosen structuring model such as relational, geo-relational, network, and hierarchical. For this project, relational (table) structuring method was used due to its easy implementation and management.

All geospatial and non spatial (attribute) data were structured and actualized to form a database in a format acceptable by the implementing software and hardware. Thus, point, line and polygon layers were created for spatial objects on the digital map. Attribute data needs of the database were also structured as shown in the following tables.

This was done such that;

(i) Stored information can be accessed and retrieved at a later date

(ii) Update can be done from time to time.

(iii) Analytical functions can be performed to answer some generic question for the study

IV. RESULTS AND DISCUSSION

The results obtained from this research include statistical analysis of spatial spread of voters, updated Awka South

road map of the study area showing the polling units, and various queries conducted on the geospatial database.

The key results are discussed below in the following subsections

G. 4.1 Population and Voter Spread

According the voter register from INEC, Awka south LGA has a total voter population of about 135,146 people. The number is spread among the communities that make up the local government

Table 4.1 showing Voter Population and Spread

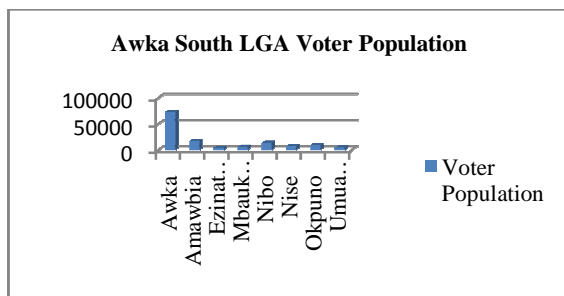| Towns	Voter Population	Percentage %
Awka	72663	54
Amawbia	17185	13
Ezinato-Isiagu	3898	3
Mbaukwu	6300	5
Nibo	13763	10
Nise	7318	5
Okpuno	9443	7
Umuawulu	4576	3
Total	135146	100

Fig. 4.2 :Bars showing Awka south LGA Voter Population

The result shows that more than half of the registered voters (about 54%) in Awka south LGA were registered in Awka town. This supports the claim of Ministry of Economic planning & Budget that "Awka as the seat of government is the only urban area in Awka south local government".

The importance of the information/data on voter population and spread cannot be over emphasized especially as it relates to decision making in electioneering. First this information can be valuable to politicians to be able to know where to concentrate and allocate resources during campaigns and advocacies. Second, electoral officials will find this data invaluable in making decision as relating to allocation of personnel to areas where they will be needed most. Third election monitoring teams will also find the data useful as it will guide them on how and where to posting of monitoring teams. Again the security agencies

will benefit from this data as it will help them in deployment of more officers and men to areas of large population and probably fewer men to areas of low population.

H. 4.2 Mapping of Polling Units

The map of the study area showing all the two hundred and fifty five (255) polling units was produced (see figure 4.3)

From the maps produced, Awka town has a total of 108 polling (about 42% of the 255 polling units of the study area), Nibo has the next highest number of polling units with 36 (14%) followed closely by Amawbia which has a total of 30 (12%). Nise and Mbaukwu has a total of 20 polling units each (8% respectively), while Umuawulu has 16 polling units Isiagu-Ezinato has 14. Okpuno has the least number of polling units i.e. 11, 4% of the 255 polling units (see table 4.2 and figure 4.4)

Table 4.2 showing Polling Units and Voter Population Spread

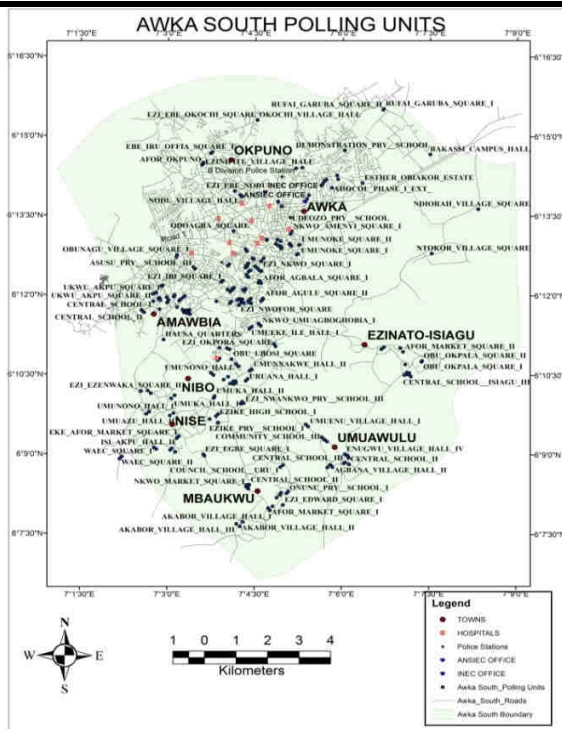| Towns	Total Polling Units	Percentage %	Voter Population	Percentage %
Awka	108	42	72663	54
Amawbia	30	12	17185	13
Ezinato-Isiagu	14	6	3898	3
Mbaukwu	20	8	6300	5
Nibo	36	14	13763	10
Nise	20	8	7318	5
Okpuno	11	4	9443	7
Umuawulu	16	6	4576	3
Total	255	100	135146	100

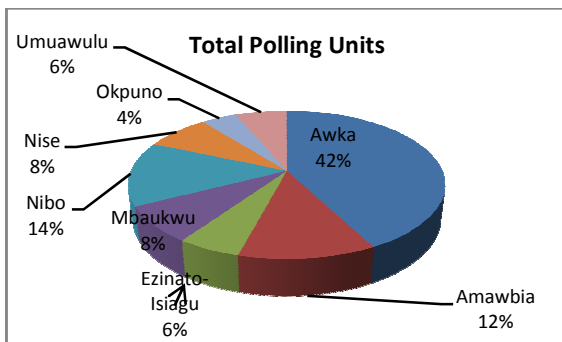*Fig. 4.3: Awka south Polling Units*

Fig.4.4: Pie Chart showing Polling units spread

4.3 Database Query

A single query was performed to determine all the polling units with over 500 registered voters as shown in figure 4.4.
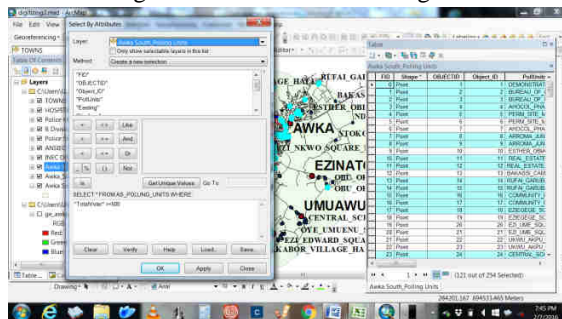

Fig. 4.4: showing the query result of all polling units with over 500 registered voters

The results showed that 121 polling units out of the total 255 has registered voters of above 500 voters.

The second query, a multiple query, was to know all polling units located at Okpuno Registration Area with over 500 registered voters was performed and the result (figure 4.5) showed that 9 out of the 11 polling units in Okpuno has over 500 registered voters respectively
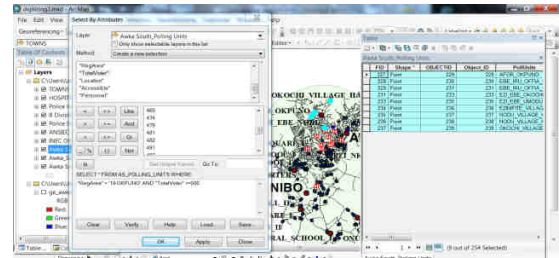

Fig.4.5: showing the query result of all polling units in Okpuno Reg. Area with over 500 registered voters

The third query is a single query to show all polling units located at a market square in the study area. And the result showed that a total of 28 polling units are located at market square (see figure 4.6).
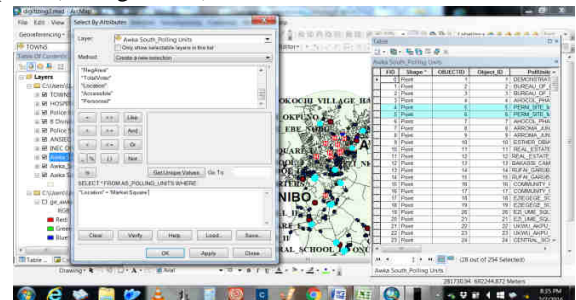

Fig. 4.6: showing the query result of all polling units located a market squares

The last query was to show the polling unit register. A polling unit was hyperlinked with its polling register and from there search for individual voter can be conducted. The result of the hyperlink and the search is shown in figure 4.7.
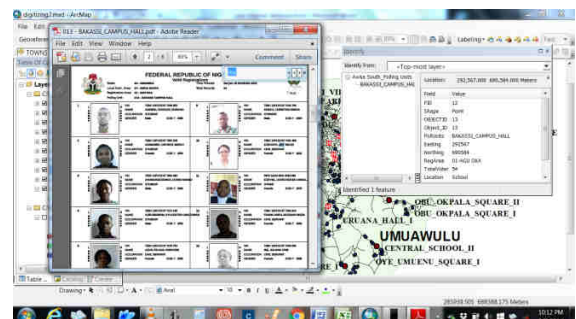

Fig. 4.7: showing the hyperlink and search in the polling register.

V.   SUMMARY AND CONCLUSION

This research has successfully demonstrated the use of Geographic Information System based approach to monitoring election in Awka South Local Government Area of Anambra, State, Nigeria. The following findings were obtained from the study:

i.   GIS based mapping is one of the best techniques of depicting spatial data, the location the polling unit was depicted and it was noticed that there are no polling units located at around/within Ngozika and Udoka Housing units.

ii.   GIS based electoral system can provide efficient database for officials, and will be useful to enhance officials to conduct, manage and monitor election.

iii. It will also enhance geographic visualization of electoral dynamics and electoral demography.

GIS based electoral system will provide efficient database and also be useful to enhance officials to conduct and manage elections. GIS based mapping is one of the best techniques of depicting spatial data, the locations the polling unit was depicted.

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