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Application of Geospatial Techniques in locating Polling Units in Esan West LGA, Edo State

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Abstract: This paper is focused on the application geospatial techniques (GIS) solution in electoral process through location and mapping of existing polling units, their distributing pattern, distance variation as well as the factors to be considered before siting polling units (station). Random sampling technique was used in selecting five wards as a fair representation of the ten wards in the study area. The data generated where analyzed using descriptive and inferential statistics, GIS software (ARCGIS 10.0) and google earth. The result indicates that the polling units are not spatial distributed but clustered in nature. The results also indicate the polling units are close to linear feature like roads. Based on the findings, recommendations were made on the use of GIS in locating polling unit toward spatial coverage of the entire study area.
Keywords: Geospatial Techniques, GIS, Mapping, Polling units, Location.

INTRODUCTION

GIS is not just magic box, as people assume it to be, it is simply an extension of one's analytical thinking it has no inherent answers, only those of the analyst, it is a tool, just like statistics is a tool, it is a food for thought[1,2]. GIS will be a very useful tool for promoting free, fair and credible election as a means of ensuring that democracy and good governance prevails in the Nigeria and Africa at large, even to other countries of the world; all these can be achieved if the polling station as centers of vote collection are well located(or mapped).

Once the location of voting sites have been officially approved map should be prepared showing the location of voting stations and relevant electoral districts and voting subdivision boundaries and to overcome such difficulty, GIS techniques comes as a helping tool in order to generate such comprehensive maps in a precise manner with the help of it relevant process. The timing of production of these maps is very important and should be one of the first actions to be undertaken as soon as voting stations location are determined.

Location is one of the essential (basic) geographical concepts, it has been noted that the location of objects and places is the starting points of all geographic study. In addition to its literal meaning a location is an area, commonly recognized and defined in which human activities take place [3].This can be in the form of a point or area; based on the scale employed or used. This can also vary in size from a country to a locality hence its importance to geography[4].

However, this paper lays emphasis on the location and effecting mapping of civic right facilities namely: polling station using GIS methodology for a free, fair and credible election in Nigeria. Election under this context can be defined as an occasion when representative, office holder etc, are chosen by vote, this is usually carried out in a particular designated Centre for such activities called polling stations. For an election to be free, fair and credible it has to be void of election malpractice of any nature. Adequate location of polling station helps to eradicate or reduce electoral malpractices if not reverse is the case. This also will help to build political stability in a large number of African countries that will make up or consider the use of GIS for electoral process (Location of polling station).

Polling station (voting Centre) is one that should be available to people within a community/ward in general without any form of influence (bias), because they are meant to satisfy the civic needs of the people. The proper location/accessibility of polling station, just like educational service, health service and others is an essential feature of a well-developed political region, or any settlement and therefore should be sought after by politicians, community and opinion leaders. The irregular location of polling station in Nigeria has been

a major obstacle for free, fair and credible election in Nigeria. Most polling stations located are usually influenced by individuals (well connected), high government officials, as well as traditional rulers. It has come to notice that during the past or previous elections polling stations were being located in traditional palace. Based on this backdrop, the chairman of Nigeria electoral body (Independent National Electoral Commission-INEC), Prof. Attahiru Jega announced in 2011 that no polling stations will be placed or located within any traditional palace across the country.

Generally, the electoral process in the country (Nigeria) faces many administrative and political problems which have challenged meaningful, open and democratic elections in the country[5]. Among the most serious and blatant cases of electoral fraud are irregular location of polling station, rigging, destruction or disappearance of ballot boxes, unless these vices which are embedded in the electoral culture of the country are effectively addressed, conducting free, fair and credible elections in Nigeria(Africa) in the years ahead will be a mirage(out of view). It is for this reason and development, we all should shift our attention on the relevance of GIS as tools (solution) for free, fair and credible election in Nigeria.

MATERIAL AND METHODS

Study area

Esan west local government area is one of the 18 local government areas of Edo state, located within the Niger Delta region of Nigeria. It was formerly one of old Okpebho local government area which was splinted into two in the year 1991and it has its headquarters in Ekpoma.It is located between latitude 6°20N and 6°50N and Longitude 6°00E and 6°15E of the Greenwich meridian. It has an area of about 502km² and a population of about 125,842 at the 2006 census.It has an area of 502 km² and a population of 125,842 at the 2006 census.

The area is bounded in the north by Etsako West Local Government Area, by Owan west local government area in the north west, in the east by Esan central local government area; in the south by Igueben government area and lastly by Uhumwode local governmet area.

Material

The data for the paper work were sourced from two main sources:

Primary source: This include the use of GPS to collect data(x and y) coordinate of existing polling station location , use of oral question as regard the factors to be consider before creating a polling station, accessibilities and ownership/nature of centers.

Secondary source: This includes the use of relevant textbooks, articles, journals, published and unpublished statistics from INEC (location of existing polling station), and topographical maps, Arcgis 10.1 software.

Methods

The nature of data employed (used)-collected include; population data (eligible voter/registered voters), from 18 years and above, existing polling station location, nature of polling station and factors considered in terms of location and distance.

Based on the fact that Esan West Local Government Area is made up of 10 wards and is very large; random sampling method was used to sample 5(five) wards out of the total 10 wards of the local government area, as shown in the table below.

Table 1: Showing the Ward Selected.

S/N	Ward Selected	Name of Ward
1	4	Eguare/Emaudo
2	5	Ihumudumu/Idumebo/Ujemen
3	6	Iruekpen
4	7	Emuhi/Ukpenu/Ujoelen
5	10	Illeh/Eko-ileh

Sources: Field work 2011

As earlier stated the sample random sampling method was used, in which each members in the sampling frame (the population under study) had an equal and independent chance of being included in the sample. The method involves random selection from a list of the sampling frame (population) the required number of subjects or element for the sample. Out of the four ways of conducting random sampling, the lottery method popularly called by means of lottery was used for this work, in which each item (wards) in the sample frame was represented. Wards identification were written on a piece of paper (1-10) and thoroughly mixed together and a sample of appropriate size n were picked out randomly without replacement. This includes the listed ward above (see table 1).

From the INEC office within the local Government Area the location of existing polling station were sourced from (hard copy);from the data I was able to identify the location of the existing polling stations within the 5 ward under survey. The x and y co-ordinates of the existing polling station were collected

using the Germini Global Positioning System(GPS).The population/registered voters data of each ward were also sourced from the relevant authorities.

The map showing the location of the various wards were sourced, from the local government area office (map department), which were later reproduced and scanned into ArcGIS 10.0 environment. The map was digitized to show different layers as well as a base map showing the location of polling station.

Traditionally the data were analyzed using tables and maps as well as descriptive method, from the charted point different maps were created. The topo map sourced from the local government secretariat as earlier stated was scanned and georeferenced within the ARCGIS 10.1 and QGIS 2.0 environment and projected to the geographical co-ordinate system and the various layers digitized were also projected to the same unit[6]. The GPS points (polling station) were also projected using the UTM with the Nigeria zone. With this it was possible to chart the point on the map.

RESULTS

In totality the area under study is made up of about 73 polling stations (voting centres), with 112 polling units. Because it is a large area five (5) wards were selected for detail analysis. From the five (5) wards selected a total number of 32 polling stations (with 63 polling units) were under review having a total of 47,786 as registered voters as against the general total of 63,259 of the entire 10 wards. The table below helps to explain better.

Table 2: Polling Station Distribution

Ward Code	- Name of Ward	Polling Station		Polling Units		Registered Voters	
		NO	%	NO	%	NO	%
4	Eguare/Emaudo	8	25	17	26.98	15,070	31.54
5	Ihumudumu/Idumebo/Ujemen	3	9.38	9	14.29	8,141	17.04
6	Iruekpen	5	15.63	13	20.63	9,182	19.21
7	Emuah/Ukpenu/Ujoelen	9	28.12	15	23.81	12,554	26.27
10	Illeh/Ekoilleh	7	20	9	14.29	2,839	5.94
TOTAL		22	100	63	100	47,786	100

From table 2 above it is shown that Emaudo/Eguare ward has a total of 8(25%) polling station with 17(26.98%) polling units of the total sampled and 15,070(31.45%) registered voters.

Ihumudumu/Idumebo/Ujemen accounts for 3(9.38%) polling station with 9(14.29%) polling unit of the total sampled and 8,141(17.04%) registered voters.

Iruekpen ward accounts for 5(15.63%) polling unit of the total sampled and 9,182(19.21%) registered voters.

Emuhi/Iruekpen/Ujoelen ward accounts for 9(28.12%) with 15(23.81%) polling unit of the total sampled and 12,554(26.27%) registered voters.

Illeh/Ekoilleh ward accounts for 7(20%) polling station with 9(14.29%) and 2,839 registered voters.

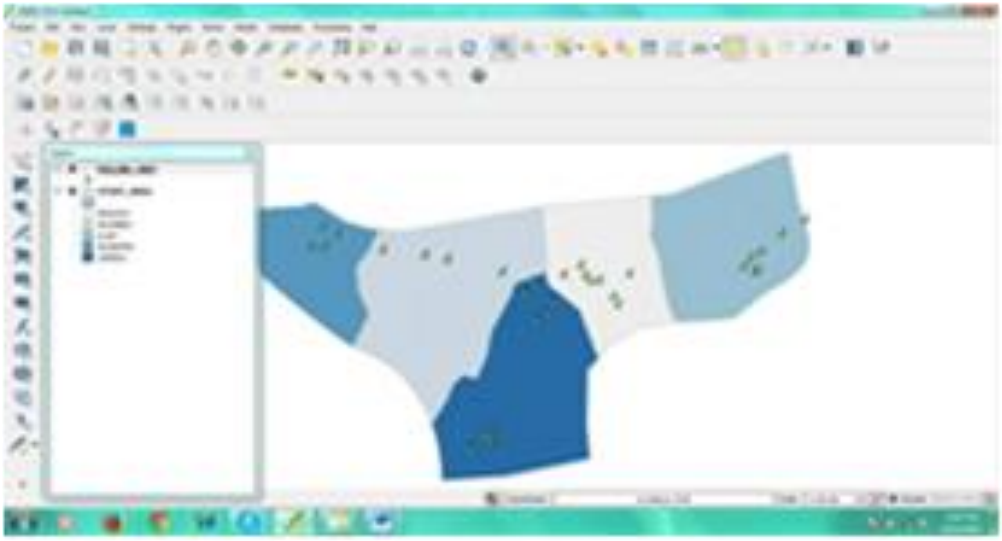

Fig-1: Number of Polling Unit in Each Polling Station (QGIS 2.0.1)

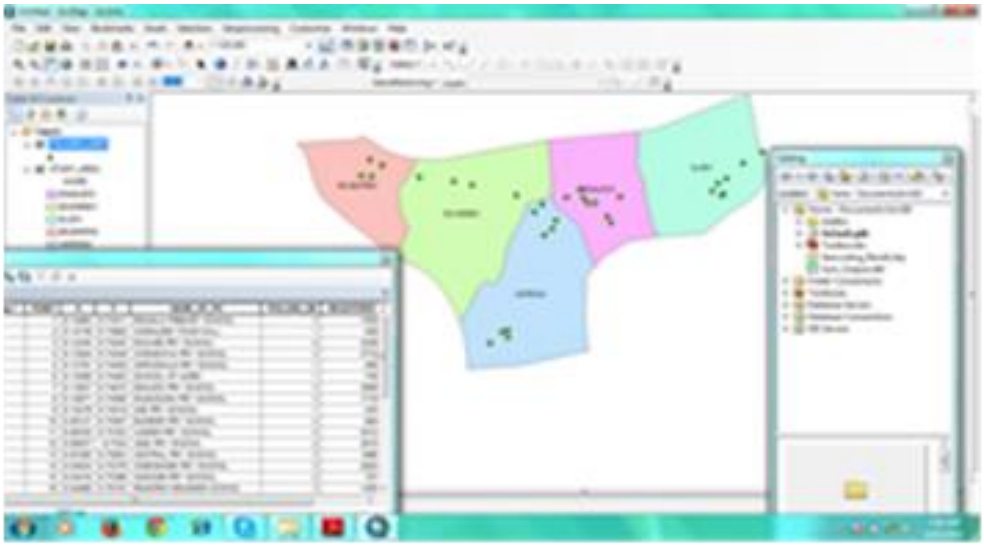

Fig 2: The Attribute Data of Polling Unit (Stations) Ward and Location (ARCMAP 10.0)

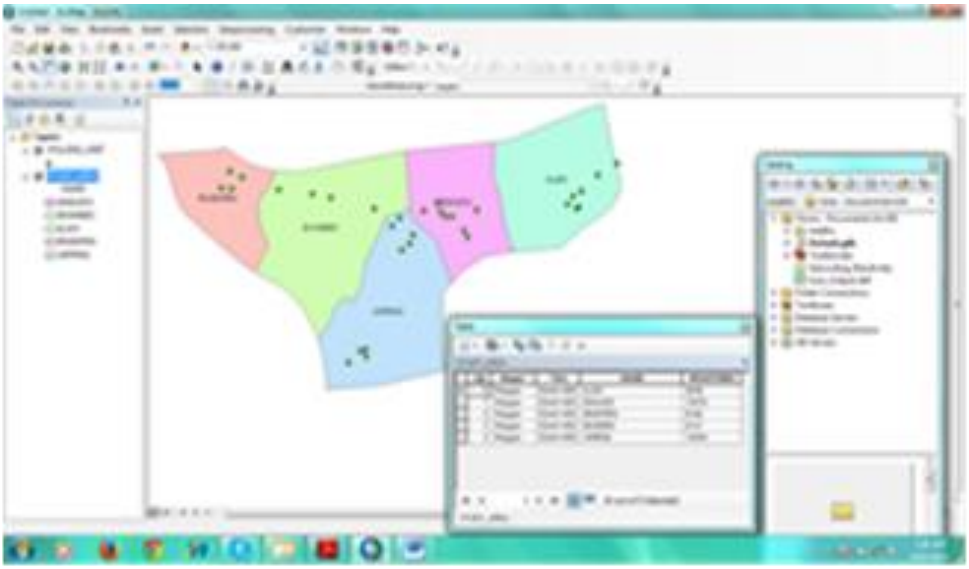

Fig 3: The Location of Polling Unit, Ward (ARCMAP 10.0)

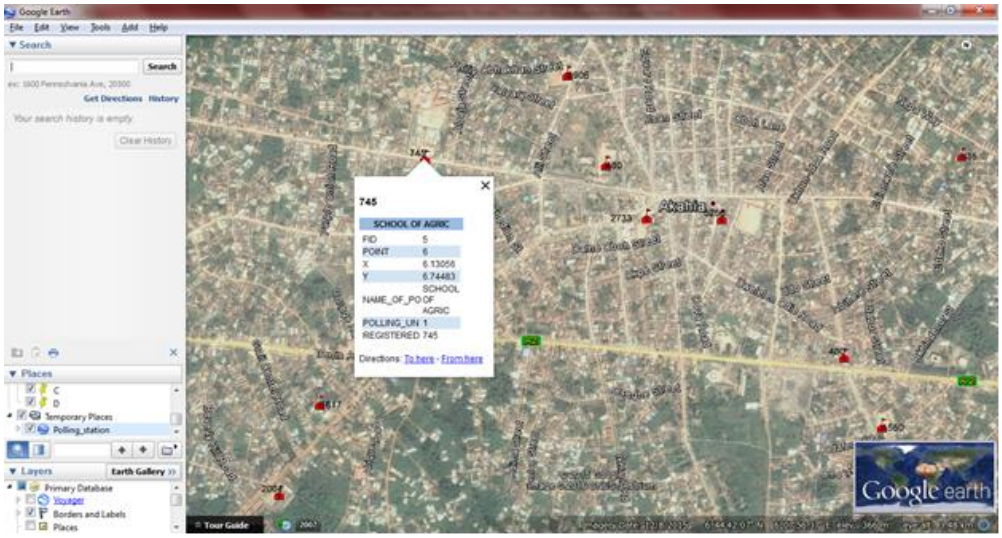

Fig 4: Registered Voters and Their Details (As Display on Google Earth, Exported From ARCMAP)

Table 3: Analysis of Factors Considered for Polling Station Location

Ward code↓	Factors → Name↓	Access & Location	Electorate figure	Ownership & maintanance	Future change	Facilities Parking space
4	Eguare/Emaudo	YES	YES	YES	NO	YES
5	Ihumudumu/Idumebo/Ujemen	YES	YES	YES	NO	YES
6	Iruekpen	YES	YES	YES	NO	YES
7	Emuahi/Ukpenu/Ujoelen	YES	YES	YES	NO	YES
10	Illeh/Ekoilleh	YES	YES	YES	NO	YES

Source: Field work 2011

Table 4: Showing Nearest Neighbor Distance of Polling Station (SCALE 1:100,000)

Polling Station	Nearest Neighbour	Distance(Km)
1	9	1.27
2	1	0.39
3	2	0.78
4	3	0.37
5	4	0.28
6	7	0.73
7	5	0.48
8	2	1.27
9	29	4.25
10	8	2.08
11	10	0.86
12	11	1.62
13	12	1.8
14	15	0.45
15	16	0.91
16	13	0.61
17	19	0.82
18	17	0.34
19	14	9.58
20	18	0.27
21	22	0.43
22	6	1.17
23	21	0.50
24	23	1.12
25	24	0.60
26	32	2.67
27	26	1.00
28	20	11.69
29	31	0.41
30	27	0.06
31	30	0.47
32	28	0.13
TOTAL		**49.41**
MEAN DISTANCE		**1.54**

Source: Field work 2011.

CONCLUSION

Finding

The study of GIS solution to locate and effective mapping of polling station is a part of developing strategies for improving services efficiency in the area of civic facilities (polling stations) at the national level down to the grassroots. It is very imperative to mention that the study has been able to make the following remarks (observations):

1. Period to this time, not even a chart or graph that shows or illustrate polling station location, apart from a manual identification that identify the place where such station(voting centers) are found.

2. It was found out that, one to two polling station identified by INEC are non-existing polling station, a major example is the Iwue town hall at ward 7.

3. It is observed that the major factors considered before locating a polling stations at the world level is also replicant here at the local government level; such as accessibility, population, distance, open space and parking space etc. From the findings it was recorded that most of the polling stations are open space and accessible which are mainly Government owned properties such as Primary School; Secondary schools; except few which are community owned like town hall.

4. For the distribution pattern of the existing polling stations, the polling stations are clustered in nature this could be traced to agglomeration nature of the locality. Despite the pattern, the voting Centre's are also very close to a linear feature (road) etc.

5. Lastly from the research it is found out that population has a major role to play in enhancing the pattern of distribution of polling station as well as the creation of polling station or reduction of polling station.

Recommendations

The recommendations given here is to enhance future studies/research on GIS and electoral process, as well as it application on election.

The maps produced should not be seen as the final product but as a yardstick or a bearing of mapping polling station by INEC (Nigeria) as it is obtainable in the developed world. The map produced at this level should be seen as a way forward.

The non-existing polling station should be reviewed and adequately considered for the people within that region that are eligible to vote not to be disfranchised to perform one of their civic rights.

The agglomeration (clustering) nature of the town as well as the polling station should be given all the urgent attention needed; as the town begin to expand from the city centre to the outskirt, automatically result to increase in population (eligible voter).This should draw the attention of the civic authorities for the creation of more polling stations of the affected area (as 500 persons makes up a polling unit).

The gap between National Population Commission (NPC) and INEC should be closed.. The voters registered of INEC should be updated every four years (General Election Purpose).For those people who will be up to 18 years as minimum age for voting in the next four years. This will help to reduce cost and minimize time spent on voter registration.

The INEC should come up with a robust GIS department that will be responsible in updating the voters register from time to time, through Database Management Module.

For there to be free, fair and credible election in Nigeria(Africa),polling place at which an electorate is required to vote should be published on a public notice called the "situation of polling places" prior to an election and can also be printed on a pollarcard which is sent to your address before an election.

The returning officer who normally decides on which places are designated as polling places, should be able to review the existing polling station every four years to assess the suitability of the facility for the voters. This help to check the abnormalities of locating non-existing polling station as in the case of ward 7(Iwue Town Hall, Emuhi).

Lastly, training should be given to the staff on how to create map (polling station map) based on the following: Cartography, web based GIS application, use of GPS, access to google earth.

Conclusion

In spite of the high level of uncompromising, constraints that may be involved in the implementation of some of the listed recommendations. Notwithstanding the researcher call for the mutual co-operation of the Government at all levels, Non-Governmental Organization (NGO), the Independent National Electoral Commission (INEC), relevant authorities and general public at large to support this drive. With no part removed or left out it is the candid opinion of the researcher that if the recommendations stipulated are fully implemented by all stakeholders, a meaningful improvement will undoubtedly be attained. This will in turn bring about an improved electoral system, which will enhance free fair and credible election in Nigeria (Africa) and at the world at large.

The researcher therefore suggest that further studies on this topic should avail to cover area of GIS and electronic mapping, GIs and electoral process, as well as GIS and district delineations. This studies can be carried out in other department, University, Organizations, Countries as this will help in making empirical comparisons of result between departments, university, country with regards to their constraints.

Conclusively, it is also of the suggestion that, the use of GIS for election and life application issues should be encourage as it is a relatively new techniques or tools to this great part of the world.

Acknowledgement

For his enabling grace, divine knowledge and understanding, wisdom and vision for the writing of this work; the almighty God take prime position in our expression of appreciation and gratitude.

To those who believe that democracy is the government of the people and can use GIS in making it better and deliverable. To all GIS Professionals and Geography Lecturers all over the Globe. Thank you and God bless.

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