



## MAPPING AND SPATIAL DISTRIBUTION OF POLLING UNITS TO ENHANCE VOTING PROGRESS IN AKURE NORTH LOCAL GOVERNMENT AREA, ONDO STATE, NIGERIA.

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### ABSTRACT

The present structure of polling units was created in 1996 by the defunct National Electoral Commission of Nigeria (NECON), which created 120,000 polling units and 8,809 wards (Registration Areas) to serve the purpose of registration center and voting exercise.

### Goal and Objectives:

The aim of the study is to carryout mapping and spatial distribution of polling units to enhance voting progress in Akure North L.G.A of Akure, Ondo state, Nigeria. This is achieved through identifying and mapping of the existing polling units, performing spatial distribution and analysis, database creation and geocoding of the polling units.

### Methodology:

Spatial coordinates of the existing polling units were acquired with the aid of Global Positioning System (GPS). These coordinates were plotted using ArcGIS 10.6 and geo-database was created. Queries were performed to examine the ownership of the polling unit's premises and also to determine polling units with over 500 registered voters. In addition, Geocoding was done to enhance a text-based description of the location of each polling unit. Nearest Neighbor Analysis (NNA) was applied to examine the kind of distribution of the polling units. The distribution pattern was determined using average nearest neighbor analysis. The result produce Z-score = -8.843133 and P-value = 0.000000, the Nearest Neighbor Index (NNI) value is 0.551025 which describe the distribution of the polling units to be clustered.

### Results:

The result shows that some polling units attributed to the study area are outside of the boundary, 63 of the polling unit's premises are privately owned while 43 are located in government facilities. It is hereby recommended that this study should be adopted to eradicate the barrier of identification and navigation to the polling units.

### Keywords

*Polling units, Spatial distribution, Mapping, Geocoding, Nearest neighbor analysis*

## **1. INTRODUCTION**

Professionals may plan successfully and efficiently by using maps to understand visually the complicated spatial linkages. Geographic Information System (GIS) technology is used in mapping and geographic distribution to add values to polling unit information. A Geographic Information System (GIS) is a computer program that gathers, stores, verifies, and displays information about locations on the surface of the earth (Martindale, 2021). GIS offers practical methods for collecting, preserving, and interpreting spatial data. Today, digital mapping is a crucial tool for addressing a variety of environmental issues (National Geographic Society, 2022). The process used to create digital maps depends on the amount of information necessary, how the map will be utilized, and the data used to create it (Tracey & Taylor, 2019). Organizations can get a considerable analytical and operational advantage by using digital mapping activities. Even those who are not professionals in Geographic Information Systems (GIS) can benefit from using location to make more informed decisions on a daily basis thanks to location intelligence (Otaru & Abubakar, 2013).

A polling place is a set place where registered voters go to cast their ballots on election days. The primary focus of many important aspects of the election process is the polling place. To calculate representation, voting units are placed together inside electoral boundaries. On election day, they also act as registration centers (Independent National Electoral Commission (INEC), 2015). As a result, the essential "unit of analysis" for an individual or group attempting to evaluate the procedure and result is the polling unit. In Nigeria, voting units are situated in places that serve various functions, including schools, town halls, local government offices, and sports arenas. Ward, precinct, polling district, or constituency are all names for the location. Presiding officials, his assistants, and security personnel work at the polling places to oversee the voting process and assist voters (Okosun, 2016).

An effective and efficient election is greatly hampered by the lack of information regarding the polling places. It has been quite challenging for people to quickly understand how these polling units are distributed due to the lack of a map displaying the distribution pattern of polling units in the research region. Creation of database and digital maps helps in providing solution to this problem (Ayodele et al., 2023). This has necessitated the need to have a map that will show the distribution pattern of the polling units in Akure North L.G.A of Ondo State.

## 2. STUDY AREA

The study area comprises the whole of Akure North Local Government Area in Ondo state of Nigeria. The Local Government Area comprises of five major communities; Iju, Ita Ogbolu, Oba Ile, Igoba and Ogbese in Akure North LGA. It headquarters are in the town of iju/itaogbolu. These communities are located between latitudes 5°45' and 7°52'N and longitudes 4°20' and 6°05'E. The population of the area is approximately 131,587 at the 2006 census with an area of 660km<sup>2</sup> (Ajakaye, 2017). The vegetation type of the local government area is typically rainforest dominated by abundant trees and grasses. The economic activities in the area include fishing and production of food and tree crops such as cocoa, rubber, oil-palm, cashew, teak, gmeligna and indigenous tree species. The predominant occupations in the communities are farming and trading. The area has a maze of numerous drainages (Ala, Oluwa, and Ogbese River).

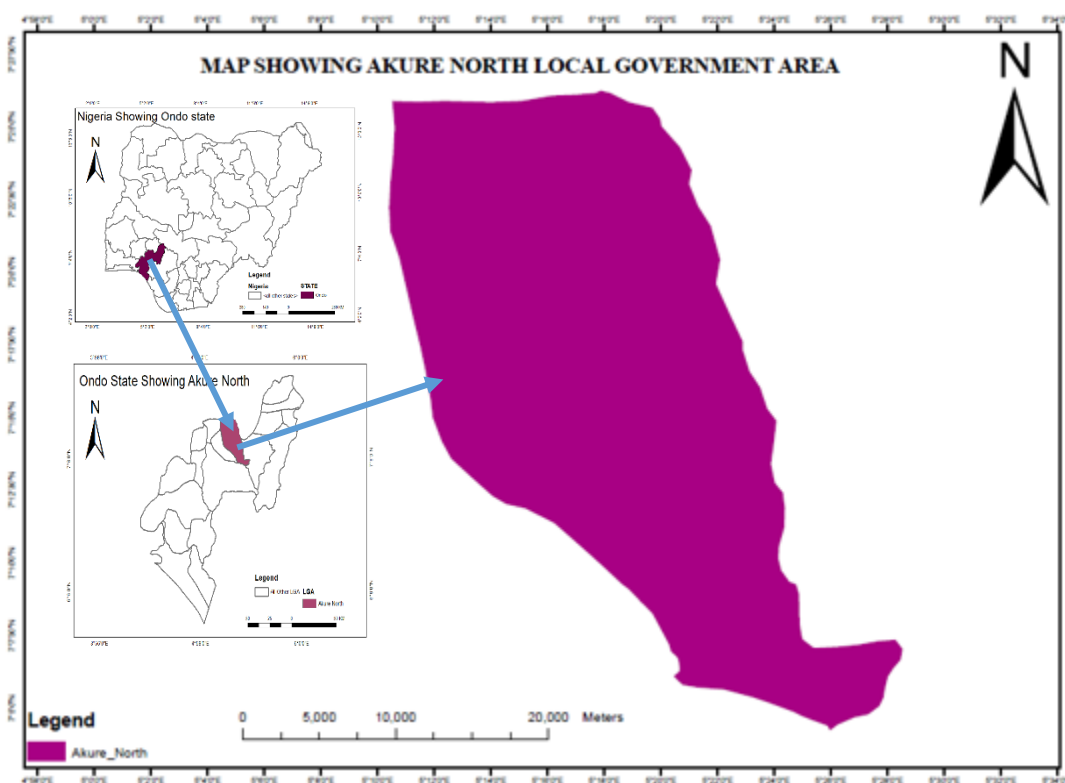


FIGURE 1. Study Area.

## 3. METHODOLOGY

Coordinates (Northing, Easting and Height of the polling units) were acquired with the aid of Global positioning system (GPS)-Garmin map 76csx. The 106 pairs of coordinates were collected with the aim of the research in mind while the secondary data such as names of the existing polling units, address of existing polling units were obtained from Independent National Electoral Commission (INEC), Akure North Local Government Office. Also, the imagery was acquired which serves as the base map. The

equipment, tools and device used for the field work includes laptop computer, field book (used for documentation) and camera (used for taking pictures of each polling units to enhance geocoding).

Arc GIS 10.6 software was used for the plotting of the coordinates of the polling units, database creation, analysis and cartographic presentation while Microsoft Excel was used for data collation and arrangement of field data. In addition, Google map was used for geocoding of polling units, Google earth pro was used for visualization of polling unit's location relative to surrounding features.

Spatial statistics assessment (average nearest neighbor analysis) was carried out to determine the distribution pattern of the polling units in the study area. Polling units with registered voters greater than 500 was queried singly, the determination of polling units where registered voters is greater than 500 in a particular ward/registration area was carried out as multiple queries. Navigation to each polling unit was enabled by geocoding the field data.

#### **4. RESULT AND DISCUSSION**

The analysis of the field data was carried out, the spatial and attribute data of the polling units is presented in Table 1.

**Table 1. Extract of polling units coordinate obtained.**

<b>S/N</b>	<b>POLLING UNIT'S ADDRESS</b>	<b>NO OF REG. VOTERS</b>	<b>EASTINGS</b>	<b>NORTHINGS</b>
1	OKE-OORE MKT/MARIYAN/OPOKITI HOUSE, MARKET PLACE	637	748244	814920
2	IGBOMOBA/AYETORO, EBENEZER PRY SCH	587	748140	815070
3	ERINWA I, II & III/ABA IJEBU ST. DANIELS PRY SCH	254	741371	817994

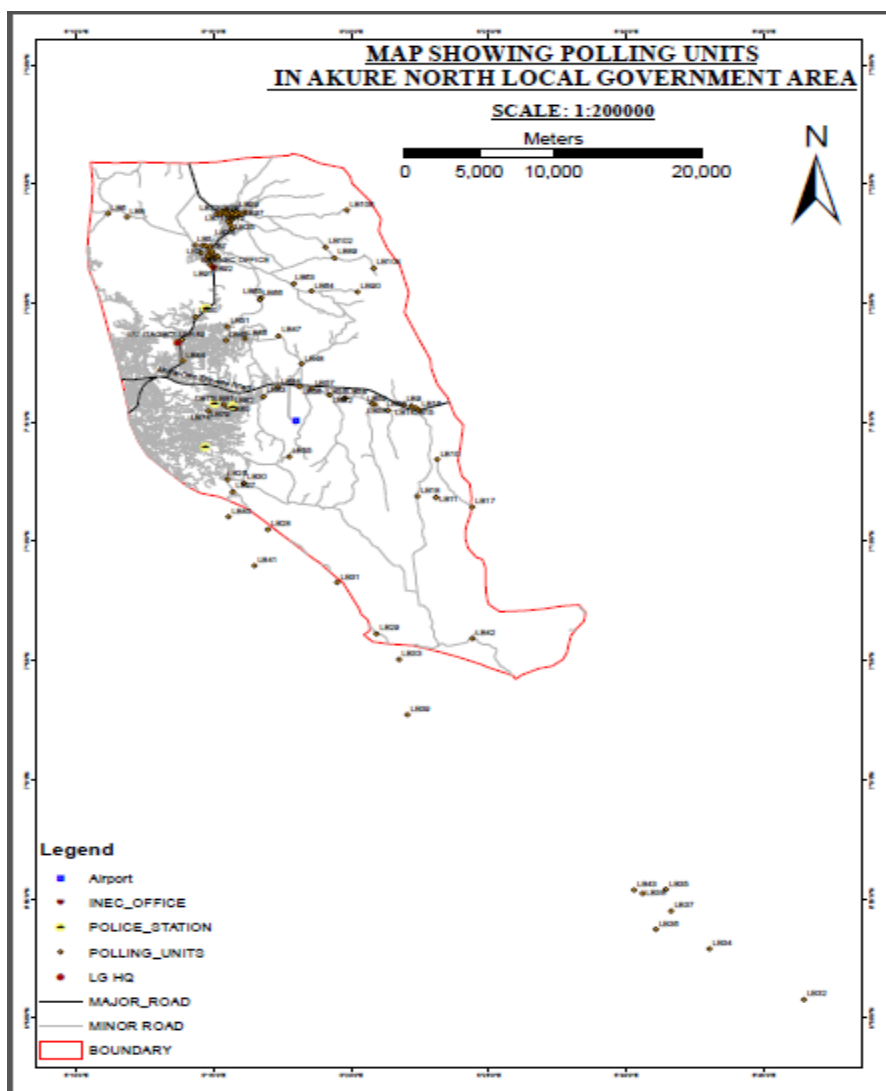


Figure 2. Map showing polling units in Akure North Local Government Area.

Based on the result shown in figure 2, it was revealed that 15 polling units are outside the boundary of Akure North Local Government Area. Most of these polling unit (14 polling units) are located in Igbatoro ward and one polling unit in Ayede ward of the study area. Meanwhile, according to INEC (Independence National Electoral Commission), these polling units are said to be polling units in Akure North Local Government.

POLLING_UN	NO_OF_REGI	RA_CODE	OWNERSHIP	PUBLIC_TOI	GSM_NET_CO	ELECTRICIT	EASTING	NORTHING	FIELD_I
ERRIWA I I & IWABA UEBU ST. DANIELS PRY SCH	254		GOVERNMENT	YES	YES	NO	741371	817994	LB6
OWODE/AJEBAMDELE/OLISA CAMP, AT OWODE	598		PRIVATE	NO	YES	YES	765968	795400	LB17
ADEJUBUL A. PRY. SCH. LA PRY SCH	740		GOVERNMENT	YES	YES	YES	752186	793593	LB28
OLOMODUDANIAGO PANU, L A PRY SCH AGO PANU	722		GOVERNMENT	YES	YES	NO	756852	789527	LB31
OLOBI, ST PETERS PRY SCH	1008		GOVERNMENT	YES	YES	NO	788281	757412	LB32
TEDIBOMI ALA, AT ALA MATERNITY	1740		GOVERNMENT	YES	YES	YES	761016	783595	LB33
FAMILUGBA, AT FAMILUGBA	684		PRIVATE	NO	NO	NO	781930	761297	LB34
FAMILUGBA, AT BOLORUNDURO	112		PRIVATE	NO	NO	YES	778998	765891	LB35
FAMILUGBA, AT EGBETA	244		PRIVATE	NO	NO	YES	778334	762791	LB36
FAMILUGBA, AT AJEGUNLE	240		PRIVATE	NO	NO	YES	779347	764214	LB37
AGO ADA, AT AGO ADA	344		PRIVATE	NO	NO	YES	777451	765571	LB38
AGO STEPHIMMALATO, AT AGO STEPHEN	487		PRIVATE	NO	NO	YES	761602	779317	LB39
ILEY OLEYO OGUNLEYE/ILEYO ODOLE, AT ILEYO HQTRS	179		GOVERNMENT	YES	NO	YES	748556	794568	LB40
ISAGBA, AT ISAGBA	325		PRIVATE	NO	NO	YES	751299	790792	LB41
OBATEDO, AT OBATEDO	598		PRIVATE	NO	NO	YES	776871	765826	LB43

Figure 3. Information about polling units outside the boundary.

### Percentage of ownership in each registration area

The percentage of ownership in each registration area was determined. A polling unit is said to be owned by government if it is located in government property e.g., schools, hospital, maternity, market place. Also, a polling unit is said to be private if it is located in an individual property. Table 2 shows that 43 (41%) polling units are located in Government facilities and 63 (59%) are located in private facilities.

**Table 2. Percentage ownership of polling units.**

OWNERSHIP	NO OF POLLING UNITS	PERCENTAGE (%)
Government	43	41%
Private	63	59%
<b>TOTAL</b>	106	100%

The determination of polling units which has registered voters greater than 500 is a single query. To perform this operation, attribute table was opened in ArcGIS 10.6 environment, on the table option in the main menu bar, Select By Attribute option was chosen. The 'Select By Attribute' window was opened and shown the attribute query. Interested field in the attribute table were selected and was added to the query builder dialogue box. The syntax for the execution of the single query is "NO\_OF\_REGI">500. This result shows that 69 polling units have registered voters greater than 500.

Moreover, the determination of polling units where registered voters is greater than 500 in a particular ward/registration area is multiple query was also performed. The syntax for the execution of the multiple queries is "REGISTRATI" = '02 - AYEDE' AND "NO\_OF\_REGI" >500.

### Nearest Neighbor analysis

Nearest Neighbor analysis was used to describe the degree of spatial clustering of a point distribution, nearest neighbor distance method uses the average distance from every point to its nearest neighbor point. Nearest neighbor distances provide an estimate of the presence of spatial dependence among events.

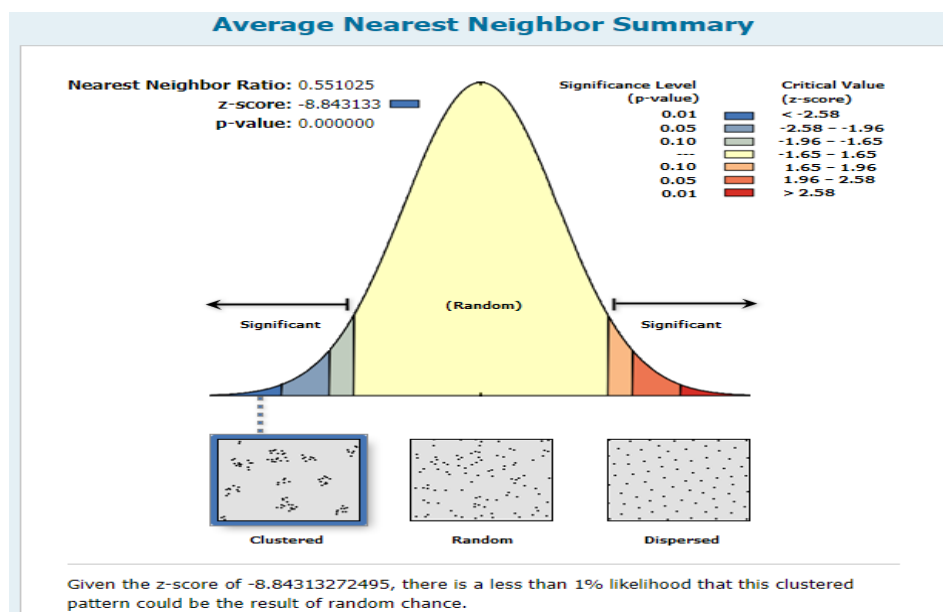


Figure 4a: average nearest neighbor analy

Average Nearest Neighbor Summary	
Observed Mean Distance:	981.1091 Meters
Expected Mean Distance:	1780.5170 Meters
Nearest Neighbor Ratio:	0.551025
z-score:	-8.843133
p-value:	0.000000
Dataset Information	
Input Feature Class:	fieldwork_Merge
Distance Method:	EUCLIDEAN
Study Area:	1344182111.438378
Selection Set:	False

Figure 4b: average nearest neighbor analysis

The significance levels adopted were 0.1, 0.05, and 0.01. In the significance level testing, such as two-tail test, the null hypothesis is rejected when the p-value is less than the significance level  $\alpha$ , under the assumption that the null hypothesis is true. If the p-value is less than the significance level  $\alpha$ , the spatial pattern is regarded as spatially “clustered or dispersed”; when the z-score is positive, the pattern is dispersed, otherwise, it is clustered (Getis, 1992; Leard, 2018). Since figure 5 shows that it is clustered and the p- value is less than the significance level and the z – score is negative, the polling units are clustered.

In consideration of the distance from INEC office to Polling unit so as to enhance dispersion and returns of electoral materials, and also to be able to calculate the distance and travel time to these polling units, there was a great need to create a buffer zone of 5km radius. Buffer operations helps in determining the existing features as well as proposing location for new ones (Samuel & Ayodele, 2022). An important spatial operation in GIS is the determination of spatial proximity or nearness to various geographic features. 5KM radius was buffered from INEC office and the result shows other polling units outside the buffer zone. With this, it is therefore recommended that an INEC area office be situated to cover these polling units so as to aid easy access to the office after voting exercise.

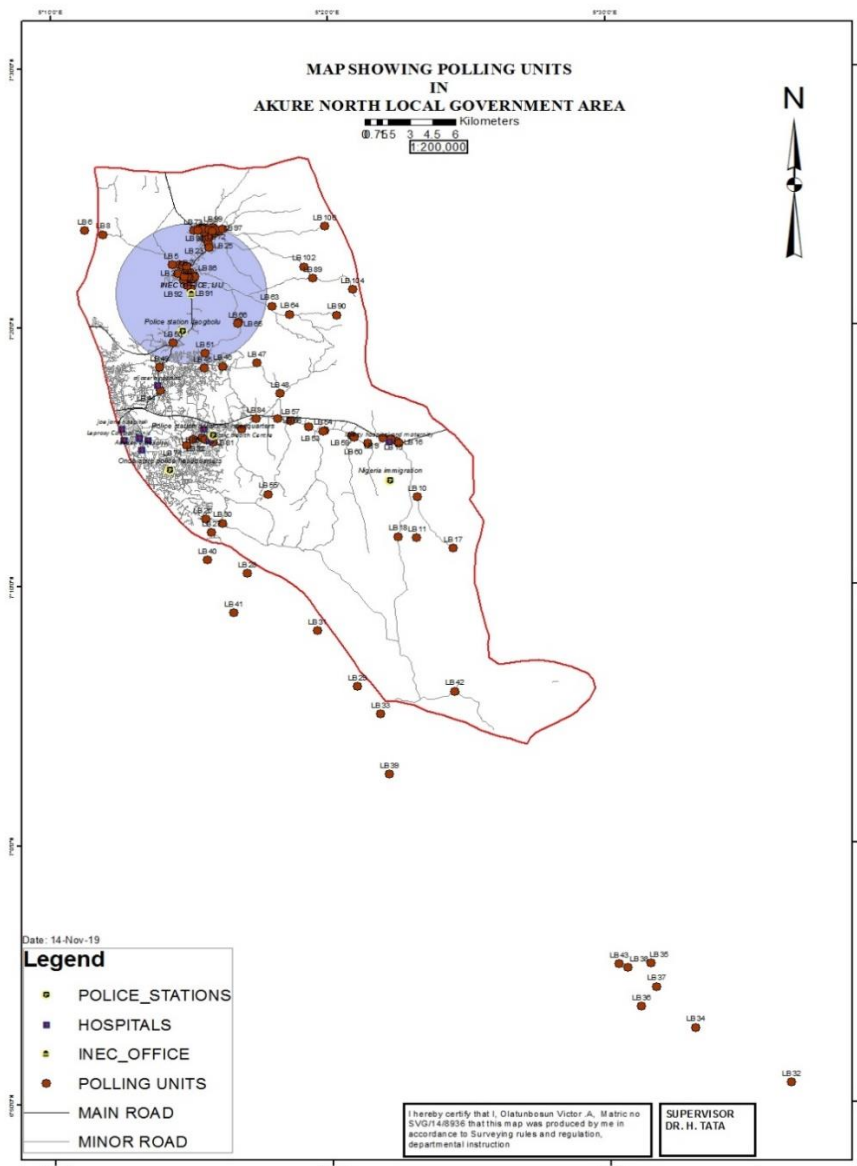
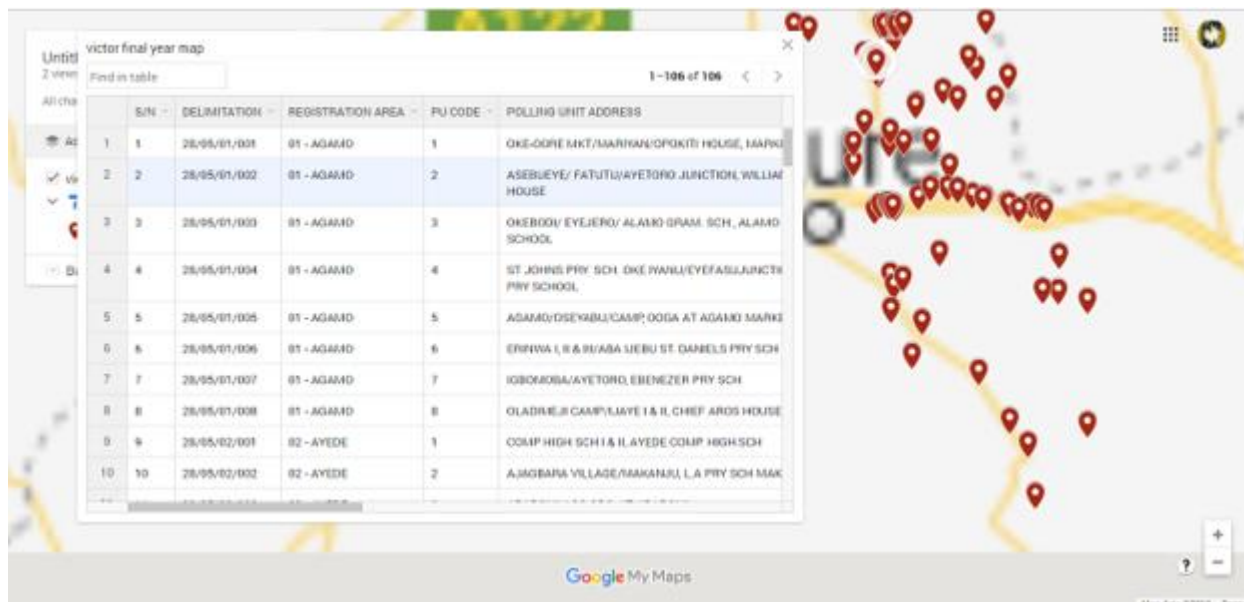


Figure 5. Buffering of 5km around the INEC office

## Geocoding



Geocoding involves transforming a physical address description to a location on the Earth's surface (spatial representation in numerical coordinates). Reverse geocoding, on the other hand, converts geographic coordinates to a description of a location, usually the name of a place or an addressable location. Geocoding relies on a computer representation of address points, the street / road network, together with postal and administrative boundaries. The purpose of the geocoding on the google map is navigation, easy location of polling units in the local government area. The geocoding result carried out in this study is shown in Figure 6.



**Figure 6. Location of polling units on google map**

## 5. CONCLUSION AND RECOMMENDATIONS

The study has demonstrated the spatial distribution of polling units in Akure North Local Government. Surveying and Geographic Information System (GIS) has proven to be a good tool in A database was created for the polling units indicating the attribute of each of the polling units. The polling units were also geocoded on Google map.

Spatial distribution was carried out by buffering and Nearest Neighbor method on ArcGIS 10.6 which the result reveals that the polling units were clustered. Finally, map showing the location of each polling units was produced.

## 6. ACKNOWLEDGEMENTS

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## 7. FUNDING

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## 8. AUTHOR CONTRIBUTIONS

Tata Herbert contributed to this manuscript as the supervisor.

Olatunbosun Victor Ayoola contributed to this manuscript as the researcher and writer.

Taiwo Oludayo Emmanuel contributed to this manuscript as a reviewer.

Titilade Adedeji Samuel also contributed to this manuscript as a reviewer.

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## 10. ADDITIONAL READING

There should be additional reading on how to make the polling units information, navigation easily available and accessible to voters.

## 11. KEY TERMS AND DEFINITION

**Polling units:** Polling unit is defined as designated location where registered voters cast their votes on election days. Polling units are main focal point for many key parts of election process. Polling units are grouped together within electoral boundaries to determine representation.

**Spatial distribution:** it is the arrangement of phenomenon across the earth's surface and a graphical display of such an arrangement is an important tool in geographical and environmental statistics.

**Mapping:** mapping is the process of making map

**Geocoding:** Geocoding is the process of transforming a physical address description to a location on the Earth's surface (spatial representation in numerical coordinates).

**Nearest neighbor analysis:** it is the measure of spread or distribution of a feature over a geographical space.