

## Geo-enabled election for efficient management of election processes in Du District of Plateau

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### Abstract

One of the major reasons adduced by the military junta in the recent waves of coup-d'etat experienced in Africa and some West-Africa sub-region was floored election process hence the need for geo-enabled election process that is vivid. The aim of this article is to geo-enabled the entire election process by delineating and standardizing electoral Constituencies and Wards to a convenient size that is relative to the demographic characteristics. The fidelity of an election process in Nigeria can only be preserved and sustained by geo-enabling the entire process in phases. The recent past election trajectory in Nigeria revealed different election maleficent that defiled all election protocols and standards. The three key stakeholders involved in election processes may not be exonerated from these election improprieties especially the political pundits and the election management body (INEC), because of their varying interests; although there are some gullible electorates willing to mortgage their votes for a morsel of bread. The article demonstrated a proto-type geo-enabled election process of Du district (constituency) in Jos South LGA of Plateau State by using GIS and GPNAS to structure both spatial and attribute election data in order to delineate effectively constituency and ward boundaries and carry all stakeholders along. The result include Constituency map with a well defined boundary, roads linking ballot places; ward maps and table showing the geographic coordinates of ballot areas. The article has unveiled to all the stakeholders what to expect from the election umpire, navigate to ballot places and how to plan effectively before, during and after election.

**Keywords:** Geo-enabled; GIS; Delineate; GPNAS; Stakeholders

### 1 Introduction

According to Best Practice (2017), Geo-Enabled Technique (GET) is a veritable tool with robust capability to provide accurate data and systems management functionalities to meet all forms of election issues or challenges and enhance the quality of electoral process in the country. There are three core systems that drive GET namely; Geographic Information System (GIS), Global Positioning and Navigation System (GPNAS) and Remote sensing System (RS) for optimal performance. The GIS was used to accurately generate constituency and electoral Ward boundaries, their spatial and attribute data of electorates, generate shortest routes or proximity to voting points, flash points areas, police stations and hospital or health centers, generate robust database for ease of integration by other systems, prompt to generate queries and others says Dates, (2000). The political pundits on the other hand might be interested in knowing their geographic extent in terms of constituencies/district and wards, locality boundaries for the purpose of political needs assessment and control and quest for more polling or voting points; knowing also the demographic characteristics of the constituent area under his or her jurisdiction and beyond; while some may want his or her political party dominate their constituencies. But, the electorates would be looking forward to having a credible and transparent elections, cast their votes within the shortest distance to place of usual residence without fear of intimidation and

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harassment, thereby avoiding voter apathy, un-militarized voting environment, except identified black-spot in the past or 'flash-spot during elections and most importantly, all the stakeholders be carried along in the voting process and their votes should represent candidates voted for. In the article of Ahmad Sabo et al, (2019) says, in the quest for effective system of voting, policy makers in Nigeria begin to advocate for e-Voting adoption as an alternative to lack of transparency, loss of confidence and trust in electoral process and other electoral related problems that encapsulate Nigerian voting system. Furthermore, countries across the globe are increasingly exploring electronic voting and counting technologies as a viable alternative to traditional ballot paper method of voting that is criticized of being vulnerable human related errors and manipulations. Elections from inception has been marred with a lot of irregularities ranging from poor processing or preparation that is always wearing a veil in secrecy; electoral umpires are biased and show sympathy towards their religious lineage or incumbent government says Adamo (1979) in his article.

In the year 2013/2014, the researcher had the opportunity of taken inventory of polling units or voting points of two adjoining Local Government Areas in Bauchi State of Bogoro and Tafawa-Balewa and establishing the geographic position using the hand-held GPS device (Germin 12) at an accuracy of + or - 3-meter radius. The amazing revelation was that, more than 75% of the polling units between Tafawa-Balewa town (Just after the First Bank Ltd) and the last locality called Bununu' (sharing border with Kanam LGA in Plateau State) were all located in the 'Bush. The only physical feature leading to these polling units are foot-paths. It implies that, these polling units were politically motivated, arbitrary and non-geographic because they are of no use to any voter and therefore ill-motive.

The concept of geo-enabled election seeks to provide answers to some of the frequently asked question by most electorates in Nigeria if the election management body (i.e. INEC) knows where each eligible voter resides. The recent article of Geo-Enabled Election by Best Practice (2023) and the article released by the EU Observer in 2023 on 'Elections held on schedule, but lack of transparency and operational failures reduced trust in the process and challenged the right to vote revealed that, most of the electoral irregularities emanated from this un-answered question.

There is also the problem of identifying the appropriate location of polling or voting place and their required number that are easily accessible to voters within a radius of at least 200-meter is still a difficult task and contentious to resolve. This article adopted the inherent visualization and analytical advantages of GIS which involves replacing non-spatial 'address file' systems with election district or constituency and voter location data in a GIS format. This is because, geo-coding of the residential addresses of voters and their demographic structure in terms of their age, topography and route net-work map ought to be made available for accurate and efficient election management, in order to avoid error leading to court litigations.

However, in the recent article of geo-enabled election (Best Practice) of 2022, provided five (5) thematic areas of considerations for a geo-enabled election process and it include; assembling a team of GIS experts, collection and sustaining a voting unit GIS layer, implementing a geo-coding strategy, assembling the best available contextual layers and defining and implementing data validation processes.

The concept of geo-enabled election for the scope of this article was restricted to geographic delimitation of constituency boundary, its Wards, localities, existing polling units and routes for the provision of service (logistics) during election.

It is against these backdrops that, this article leveraged on GET to delineate and review Du constituency boundary, its wards and other spatial and non-spatial components as a proto-type for more effective and efficient election processes.

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## 2 Materials and Methods

### 2.1 Materials

The materials used for this study was sourced from the file geo-database of the National Population Commission (NPopC) and names of existing polling or voting place from Independent National Election Commission (INEC) as secondary data set; while the primary data source be the GPS coordinates of existing polling or voting place was obtained during the field work.

### 2.2 Methods

The file geo-database obtained from NPopC was disaggregated into contextual GIS layers of interest of spatial and attribute data. The spatial include point, line and polygon or area. The polygons are localities (loc\_bound), Ward

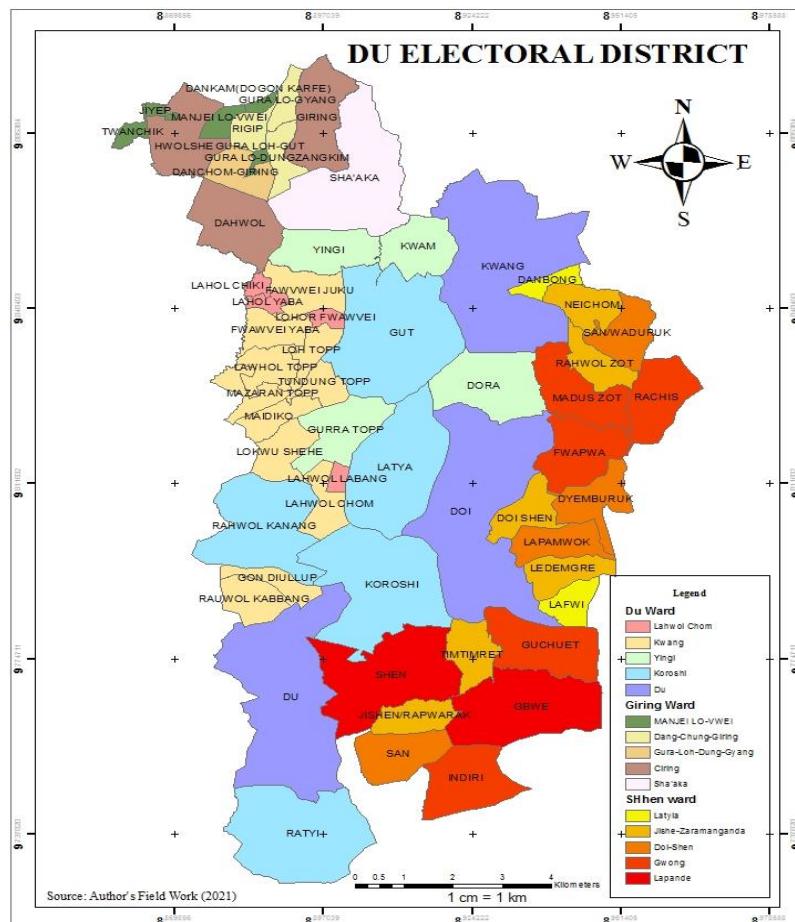
(wd\_bound), Constituency (cons\_bound); Line feature are roads (rd\_id), foot path (fpt\_id); while point feature include polling unit (pu\_id). All these feature classes were created in ArcCatalog as file geo-database because of the large volume of data; subsequently exported to ArcGIS where constituency, Ward, polling or voting point and road network maps were generated at prompt of the ArcGIS database.

For the GPS, coordinates of existing polling units established during the field work were entered in excel spread sheet and saved as .xlsx file format for ease of export and integration into ArcGIS. The polygon layer of the constituency map was then added using the 'add button tool' of ArcMap, followed by the coodinate of point layer using the same coordinate system with the polygon layer, then right-click the excel file containing PU\_Coord from the "Table of Content" and click plot X,Ycoord from the pop-up menu. Add the attribute of the coord using 'label feature' option from the pop-up menu from 'Table of content'. Then, compose the entire constituency map showing each Ward within, the road network and localities with their names using the 'data view' button from the main menu of the ArcGIS software.

### 3 Results and Discussion

#### 3.1 Output 1: Delimiting Du District or Constituency

The electoral district or constituency of Du is a combination of three contiguous electoral Wards namely; 1). Du, 2). Shen and 3). Giring. The delineation of Du Electoral District was the outcome of the edge-matching operation of the polygons of the electoral Wards at prompt of the file geo-database of ArcMap as shown in figure 1.1 below.



**Figure 1** Map of Du District

**Source:** Author's Field Work (2023)

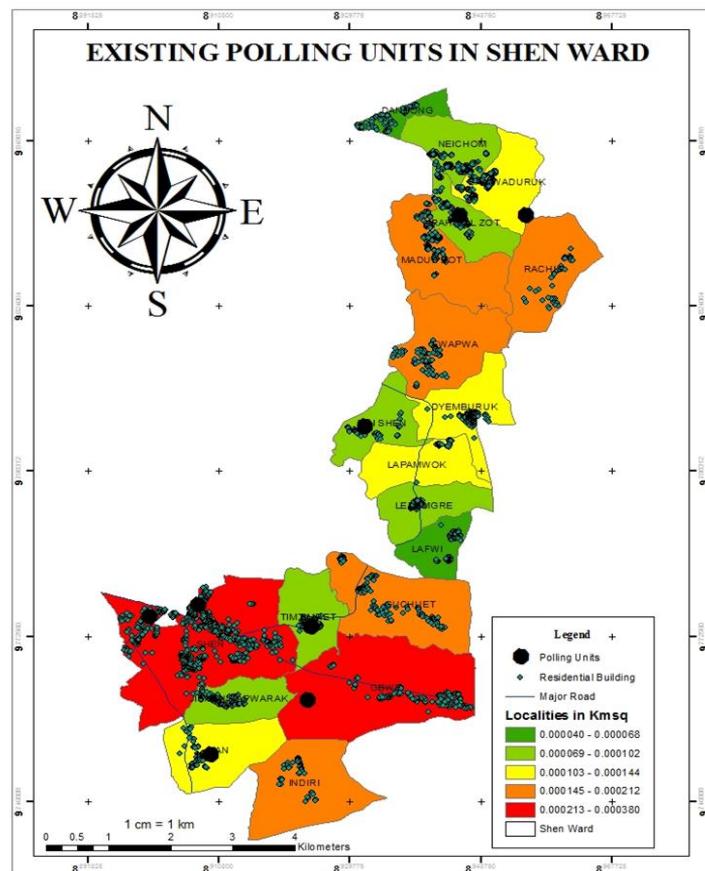
### 3.2 Output 2: Delineating Shen Ward

Table 1.1 below is the eight ballot areas in Shen electoral Ward with their corresponding geographic coordinates as obtained during the field work. But the number of ballot place or voting point is not proportional with the 2023 projected population of 38,327; which not less than 65% of this population may be at voting age (18 years and above). It implies that, there is the likelihood for voter apathy and election improprieties, particularly among the polling units along the fringes of the Ward.

**Table 1** Ballot Areas for Shen Ward

S/No.	IRA Ward	Locality	Ballot Area	Lat	Long
1	SHEN	SHEN	Kazong	9.86158	8.93095
2		SHEN	Lagal	9.80332	8.8795
3		SAN/WADURUK	Waduruk & others	9.84596	8.9462
4		RAHWOL ZOT	Zot & others	9.8382	8.94551
5		DOI SHEN	Dorowa gidindutse	9.81431	8.93001
6		TIMTIMRET	Timtim	9.7634	8.941138
Total	1	8	8	8	

Source: INEC Office (2019).



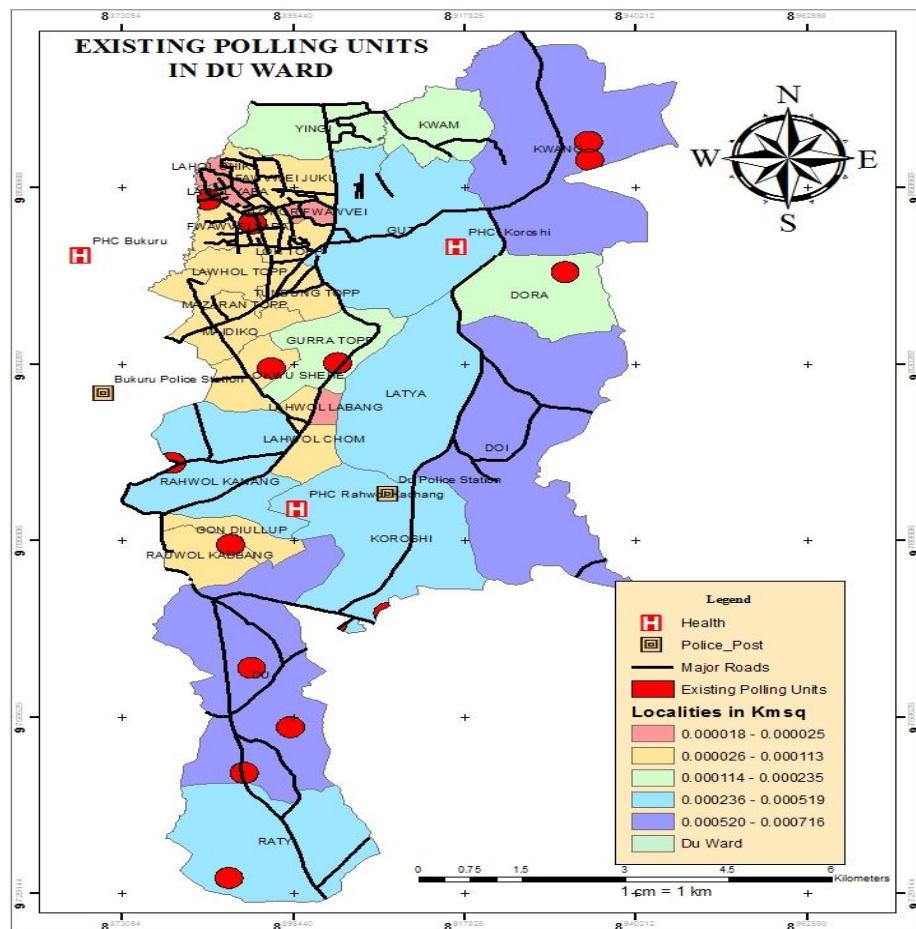
**Figure 2** Map of Shen Ward

Source: Author's Field Work (2023)

The map above in figure 1.2 shows the existing number of voting place in Shen Ward before the 2023 election was conducted; with only eight (8) and most of which are located at the fringes of the boundaries adjoining other Wards. The ballot areas are far from where majority of the voters are residing. The political pundits can easily leverage on such loop-holes to perpetrate election fraud either by conniving with the polling agents by stuffing the ballot or manipulating the result sheet.

### 3.3 Output 3: Delineating Du Ward

Du Ward as a polygon feature was segregated from Du district or constituency polygon at prompt of ArcMap as shown in figure 1.3 below.



**Figure 3** Map of Du Ward

Source: Author's Field Work (2023)

From the map above, there are eight (8) ballot areas dotted within the Ward and there is quite a distance from the residence of most voters. Some voters are most likely going to be disenfranchised on the day of election.

While table 1.2 below revealed the geographic coordinates of the eight ballot areas as obtained during the field work. The projected population for the year 2023 is 50,472 with only eight (8) voting places that are arbitrarily located. In fact, some are in close proximity as exposed on the map above.

**Table 2** Ballot Place of Du Ward

IRA Ward	Locality	Ballot Place	Lat	Long
DU	DU	Madu	9.77555	8.90059
	DU	Du	9.7642	8.88993
	DU	Kuru III	9.66273	8.71314
	KWANG	Ganfong	9.86158	8.93095
	KWANG	Chwbi-nyanko	9.86158	8.93095
	DORA	Dura	9.836	8.9309
	LAHOL YABA	Farinlamba	9.74085	8.79218
	FWAWWEI YABA	Ful da dammer	8.85534	8.89328
	LOKWU SHEHE	Lakok	9.78403	8.89762
	GURRA TOPP	Clugun Dauda& others	9.82052	8.90118
	RAUWOL KABBANG	Assakac	9.78862	8.87694
	RATYI	Rabbin Du & others	9.73621	8.8979
Total	12	12		12

Source: Author's Field Work (2023)

### 3.4 Output 4: Giring Ward

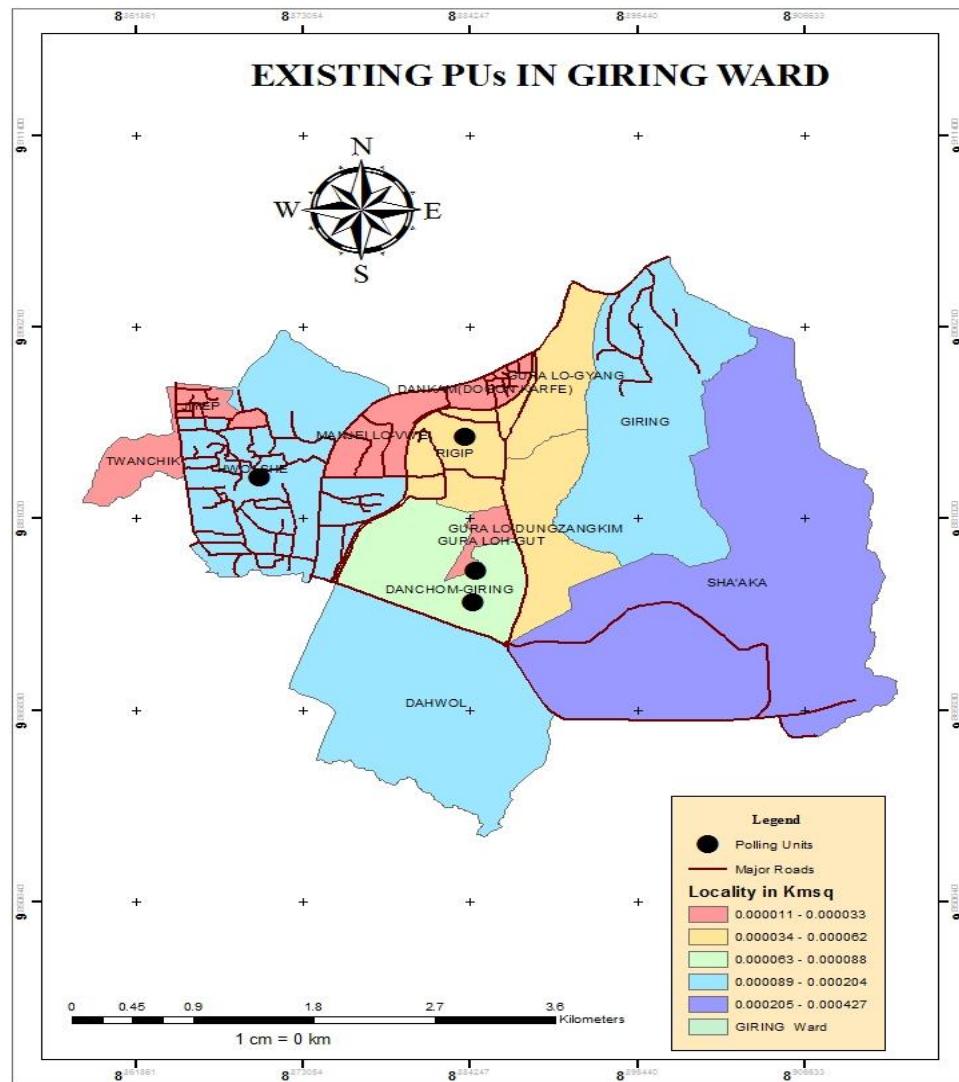
Giring Ward is adjoining Jos North local government area with a dense 2023 projected population of 40,470. Although, the people are living in clusters setting but having only four (4) voting or ballot areas. This obviously may promote voter apathy and other electoral mal-practices experienced in the previous elections. Table 1.3 revealed the locality where the ballot or voting place is located and their geographic coordinates

**Table 3** Ballot Areas of Giring Ward

S/No.	IRA Ward	Locality	Ballot Area	Lat	Long
1	GIRING	HWOLSHE	Dilimi	9.88551	8.87432
2		RIGIP	DakupyamTuru	9.77406	8.92404
3		DANCHOM-GIRING	Kurubabba	9.87686	8.88467
4		DANCHOM-GIRING	Danye ii	9.79116	8.76779
Total	1	4	4		

Source: Author's Field Work (2023).

While the map below shows all the routes within the Ward and their geographic positions. Voting places as it appeared on the map shows that, some voters have to traverse from Giring to Hwolshe to cast their votes, which may not be easily accessible on Election Day.



**Figure 4** Map of Giring Ward

Source: Author's Field Work (2023)

#### 4 Conclusion

Geo-enabled election for efficient and fidelity of the process has proven to be reliable tool or system for delineating accurately electoral Ward boundaries for timely planning and management of the entire election processes.

The tool made it possible for data custodianship in order to ease integration and standards; which allows updates for additional voting places, metadata and ease of logistics planning. This is because, the electoral umpire can obviously identify on the map where to locate the voting place and have a rough estimate of their proximity to each other.

The political pundits are abreast with the extent of their electoral Wards, the localities and ballot places, when planning for constituency projects.

However, it is pertinent to further discuss the essence of geo-coding addresses of eligible voters for ease of identifying required number(s) of ballot places and its appropriate locations. This could provide answer to question of knowing where voters are residing.

But to implement geo-enabled election in practice will require some additional investment and technology. That is, deliberate effort and commitment from election umpire (INEC) and their staff to training and keeping abreast on technology to ease and restore stakeholder's confidence. It also requires some level of collaboration across sister agencies like the National Population Commission (NPopC), change policy, and possibly supporting statutory changes.

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## Compliance with ethical standards

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### Disclosure of conflict of interest

The authors declare that they have no known competing financial interest or personal relationships that could have appeared to influence the work reported in this paper.

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