

Mapping and Evaluation of Polling Units for Optimum Election Process in Damaturu Metropolis, Yobe State Nigeria

Takana Abubakar^{a*}, Isa Alhassan^b

^a*Department of Surveying and Geoinformatics, Modibbo Adama University of Technology Yola, Nigeria*

^b*Independent National Electoral Commission Damaturu, Nigeria*

^a*Email: takana.abubakar@gmail.com*

^b*Email: isahsalimat@gmail.com*

Abstract

This study focuses on mapping and evaluation of polling units in Damaturu metropolis, Yobe State by using Geographic Information System. Polling units serves as important structures of Independent National Electoral Commission (INEC) of Nigeria. They are created with the sole aim to serve as points for the registration of voters and voting during election. To accomplish this research, the image of the area was captured and digitized and the existing polling units in the area were indicated using their coordinates captured by GPS observation. Nearest Neighbor tool was used to evaluate the pattern of distribution of polling units and the result shows that the distribution was random. The result of the service area analysis was used to show the proximity of polling units to voters based on trekking distance. The result revealed that 35 polling units will be needed in the study area based on cutoff trekking distance of 200m, 400m, and 600m. It was therefore recommended that the technology adopted in this research be used to cover the entire Yobe state for optimum election process. It is also recommended that population of voters per polling units should be used as criteria for suggesting the creation of new polling units in the area.

Key Words: Mapping; Polling Units; Nearest Neighbour analysis and Service area analysis.

1. Introduction

Mapping is the creation of map, and map is a graphic symbolic representation of the significant features on the Earth surface.

* Corresponding author.

Maps are design to illustrate specific and detailed features of a particular area, most especially used to illustrate the geography of an area. There are many kinds of maps; static, two-dimensional, three-dimensional, dynamic and even interactive. Maps attempt to represent various things, like political boundaries, physical features, roads, topography, population, climates, natural resources and economic activities. Modern technology of digital mapping process is an effective and efficient way of mapping. The process utilizes spatial data in numeric form rather than in graphical or analogue form to compile and produce maps or plans using information in a digital format [1]. The primary function of this technology is to produce maps that give accurate representations of a particular area, detailing major road arteries and other locations of interest. The technology also allows the calculation of distances from places and the area coverage of spatial entities.

Polling units or polling stations are important structures of Independent National Electoral Commission (INEC) in Nigeria. Polling units are places that are isolated or created with the sole aim to service the registered voters and also serve as place where new voters are registered in most cases [2]. Since the polling units are places set aside for voters to visit during elections, it is paramount to identify and map such important places and to show their proximity to voter. Having polling units close to voters will enhance quick and easy process of election during voting [3].

Where polling units are far away from voters it may deprive voters the right to exercise their franchise. This study will therefore map the present positions of polling units with a view to evaluate their position in terms of proximity to voters. The study will also propose new polling units base on the trekking distances for optimum election process.

1.1 Statement of the Problems

The present structure of polling units in Damaturu metropolis was created in 1996 by the defunct National Electoral Commission of Nigeria (NECON) where 49 polling units were created. This structure is still maintained till date despite the increase in population and settlement in the metropolis. In 1996 when the current polling unit structure was established, the population of Damaturu was 33,226. In 2006, after a National Population Census, the population grew to 48,014. In the 2015 voters' registration exercise that was undertaken, the population rose to 95,482 [4]. Because of the growth in population, it is evident that some settlements are not close to these polling units. These factors have, among other things, made the polling units in the area inadequate or inaccessible by the voters.

1.2 Limitation of the study

This study is limited to Damaturu metropolis in yobe state, Nigeria. The study on the distribution pattern considers the trekking distance on a fairly leveled and normal terrain. It does not take into cognizance the voting population living in the area.

2. Methodology

The methodology adopted here made use of satellite images of Damaturu metropolis captured and added to

ArcMap environment, which were geo-reference and digitized. The coordinates of existing polling units were observed using Garmin 60 Handheld GPS and was downloaded into the computer system. Spatial distribution of the present polling units was carried out using the average nearest neighbor analysis. A Service area analysis creates a buffer polygon around a destination that encompasses all areas that can access the destination within a set amount of time or distance. Service area analysis create buffers around all polling units in Damaturu metropolis showing the maximum distance a person from each perspective population center can travel. The new propose polling units were therefore proposed to be located at areas that are not serviced by the present setting at a cutoff distance of 200m, 400m, and 600m.

2.1 Data Quality

The quality of data used for any research work measured by the validity and reliability of such data. The premises for assumption here are about the trustworthiness and experience of the observer of such data. The validity of the data is determined by the precision of the instrument used and hence the precision of the set of data [5]. The precision is described as degree of closeness of set of repeated measurement to one another. The reliability of the data is measure based on the accuracy of such data while accuracy refers to the degree of closeness of the data to other sites called the true values, often referred to as “Gold Standard Data” [5]. The data used in this research was observed by an experience observer and are found to be accurate and precise.

2.2 Data Processing

2.2.1 Image and GPS data

The images were captured and merged using Adobe Photoshop 7.0 software and a composite image of the study area was produced. The image was exported to ArcCatalog environment where it was spatially referenced to WGS 1984 Zone 32. The image was later added to ArcMap environment. The image was geo-reference and digitized, shape files were created.

The data collected using Garmin 60 Handheld GPS was downloaded into the computer system to obtain the X, Y coordinates of the polling units in WGS 84 coordinate system. The data was then exported into ArcGIS 10.1 through Microsoft Excel.

2.2.2 Georeferencing

The coordinates of the identified points on image were inserted one after the other using ‘add control’ on the Geo-referencing toolbar. Geo-referencing ensures that coordinate of pixels on the image corresponds with the true coordinate of the point they depict on the ground.

2.2.3 Digitization

An on screen digitizing was adopted in this research and different layers of features were generated using the Editor Toolbar.

2.2.4 Spatial Distribution Index

The Average nearest neighbor analysis was used to determine the spatial distribution of polling units of the area using:

$$R_n = \frac{d\sqrt{n}}{a}$$

Where:

R_n = the nearest neighbor index

a = the size of the study area

d = the mean distance between polling units

n = the number of Polling units

The R_n values range from when there is no distance at all to 2.15 (when polling units have a minimum spacing and regularly distributed). A purely random distribution has an index of 1.0 value; above 1.0 indicate a tendency towards spacing and those below 1.0 indicate clustering i.e.

$R_n = 0$: implies that the distribution of points is cluster

$R_n = 1$: implies that the distribution of points is random

$R_n = 2.15$: implies that the distribution of points is regular or uniform.

Above is the Nearest neighbor index used to determine the distribution pattern of polling units in the study area [6,7,8]. Manhattan distance was also used to determine the pattern of polling units in the area with R_n value, Z score, Observed mean distance/Expected mean Distance and P-value generate.

2.2.5 Service area analysis

Service area analysis was used to determine areas that need new polling units. This was done by creating a buffer polygon around a destination that encompasses all areas that can access the polling units within a set amount of time or distance. In doing the service areas analysis, it shows how accessibility varies with impedance. Service area analysis was done within 200 metres, 400 metres and 600 metres trekking distance.

2.3 Presentation and Discussion of Results

2.3.1 Presentation of Results

Figure 1 shows the map of existing polling units in Damaturu metropolis which are forty seven (47) in number.

Figure 2 is the result obtained using statistical analysis tools for the average nearest neighbor analysis. A map of both the existing and the new polling units are shown in figure 3. A table showing the existing and the new polling units is also shown on table 1.

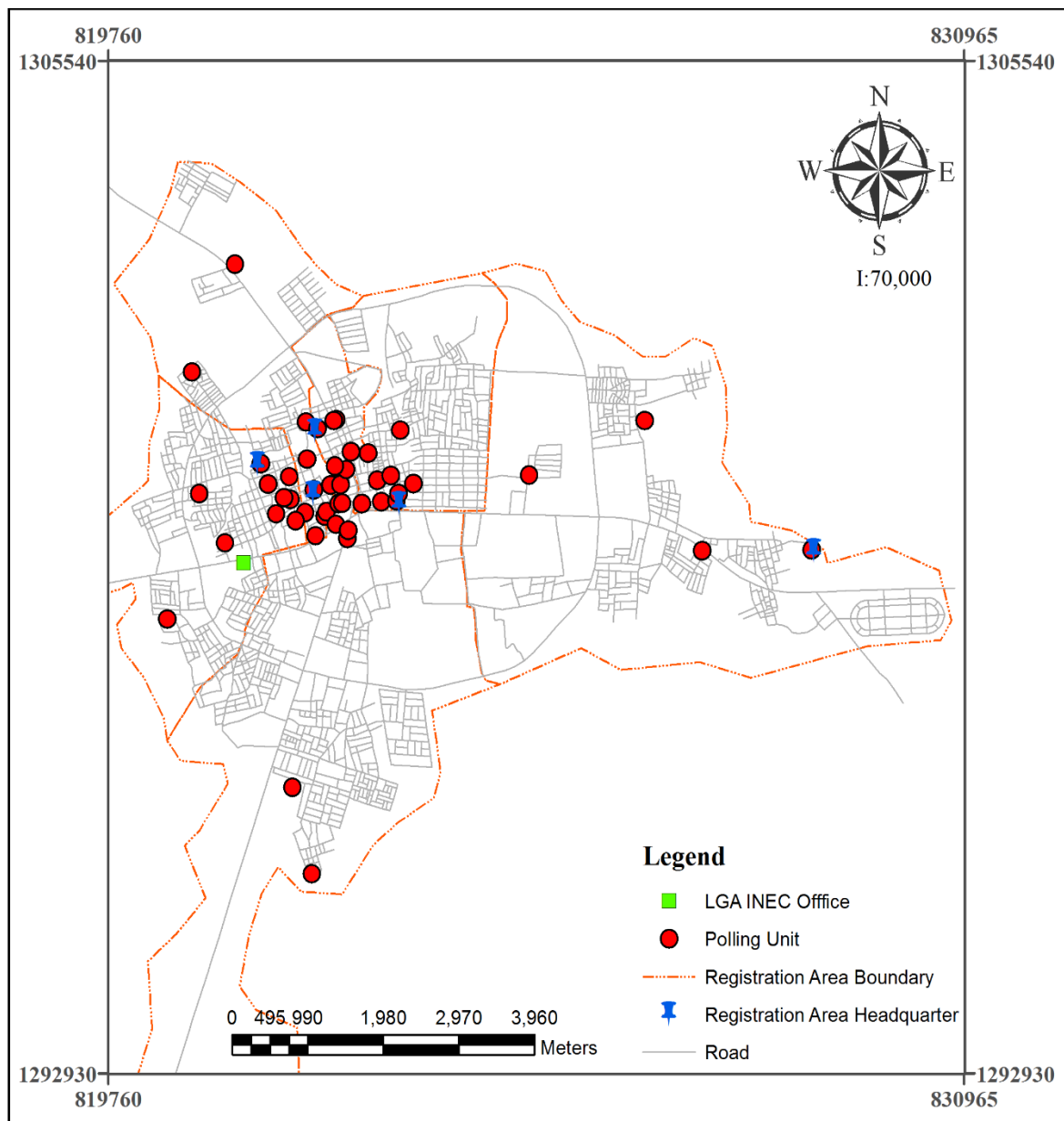


Figure 1: Existing Polling Units in the Study Area

Average Nearest Neighbor Summary

Nearest Neighbor Ratio: 0.908094

z-score: -1.205380

p-value: 0.228057

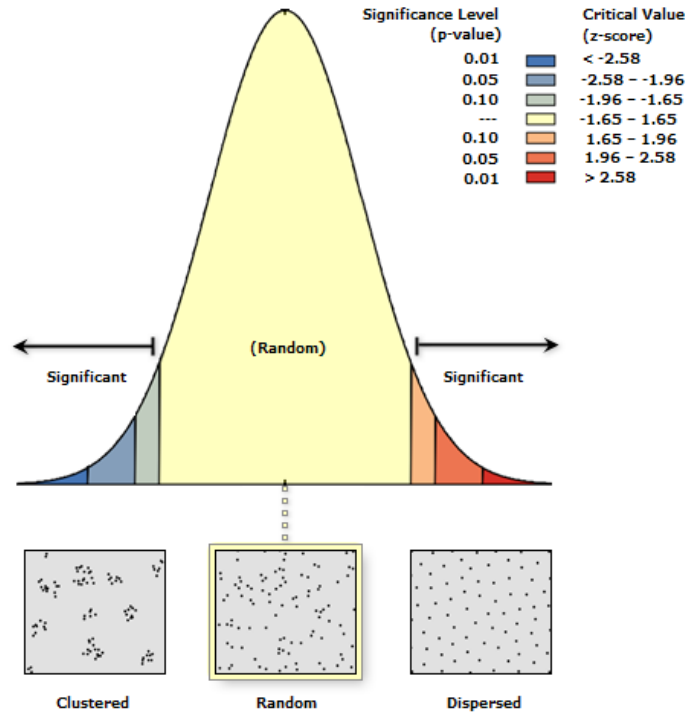


Figure 2: Distribution pattern of polling units

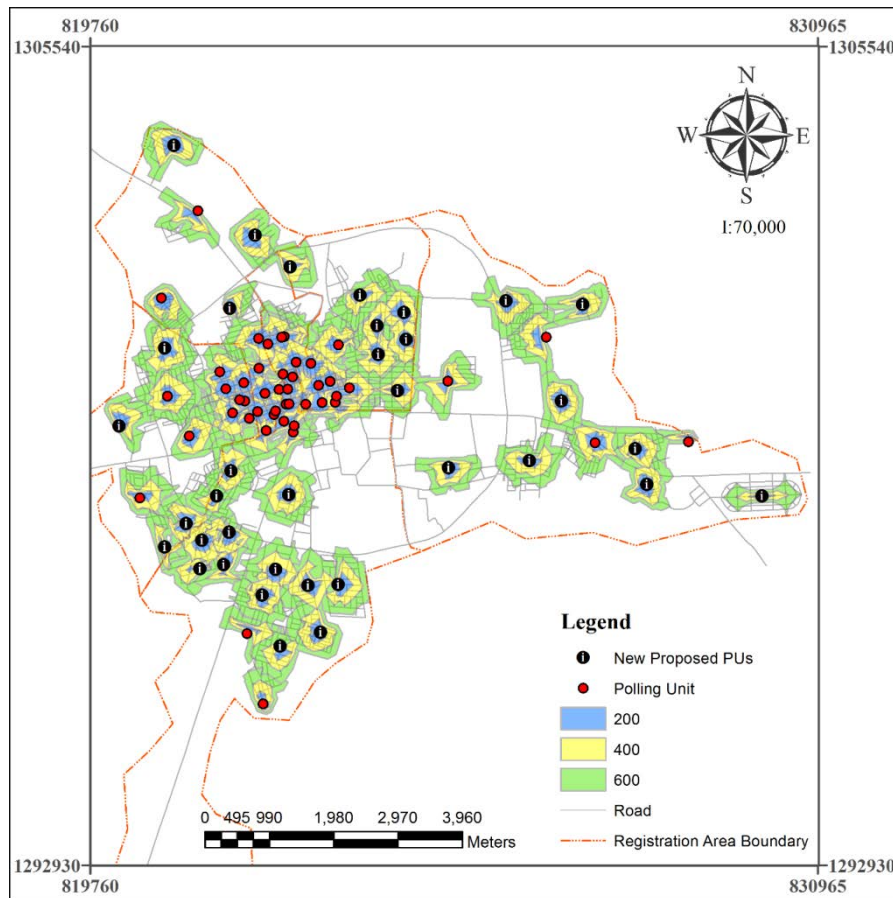


Figure 3: Existing and Proposed polling units

Table 1: Existing and Propose Polling Units per Registration Area

Registration area (RA)	No. of existing PUs	No. of new proposed
Bindigari/Fawari	10	3
Damaturu Central	14	13
Maisandari/ Waziri Ibrahim	4	8
Nayinawa	10	4
Njiwaji/Gwange	9	7
Total	47	35

3. Discussion of Results

Figure 1 is the map of the study area showing the existing polling units. The polling units in the area are forty seven (47) and seem to concentrate in the central part of the metropolis which is at a trekking disadvantage to those living further away. It is evident that most places away from the central part of the town would not be accessible to the polling units and could result to lateness and consequent denial of voting. Figure 2 is the result of the Nearest Neighbor Analysis of polling units in Damaturu metropolis and the result of the breakdown shows that the distribution of polling units in Damaturu metropolis was random despite the fact that it concentrates in the central part of the area. Figure 3 is the map of the existing and new polling units in Damaturu metropolis. The new polling units were proposed base on the 200, 400 and 600 metres trekking distance whereby 35 new polling units were proposed in Damaturu metropolis to adequately service the people in the metropolis for optimum election process. The statistics of the new and old polling units are presented in table 1. Thirty five (35) new polling units were proposed with Bindigari/Fawari Registration area having three (3) new polling units, Damaturu Central thirteen (13), new polling units, Maisandari/Waziri Ibrahim registration area has eight (8) new polling units while Nayinawa and Njiwaji/Gwange registration areas should have four (4) and seven (7) new proposed polling units respectively.

4. Conclusion and Recommendations

This research on mapping and evaluation of polling units in Damaturu metropolis has provided information on the location of existing polling units in Damaturu metropolis. The research has also revealed proximity of people to the existing polling units in terms of trekking distance. The existing polling units location appear to be inadequate and are randomly located mostly in the central part of Damaturu metropolis which shows that voters had to trek a long distance in order to get to their voting points on election days. New polling units were proposed that can cater for the people in Damaturu metropolis in such a way that they don't have to trek far to reach their polling units on election days. A total number of thirty five new polling units were proposed base on the research.

It is hereby recommended that further research can be carried out to know the adequacy of the polling units in

terms of the population per polling units to avoid congestion during voting. It is also recommended that such study should be carried out in other places to cover the entire Yobe state for an optimum delivery of voting during the election days.

References

- [1] K. N. Ndukwe. "Digital Technology in Surveying and Mapping. 1st Edition. Enugu, Nigeria. Rhyce Kerex Publisher. 2001
- [2] T. Barbara (2010). Definition and Consent of Polling Stations and Polling location. [Online]. Available: <http://www.cdn-sitelife.ehow.com>
- [3] C. Victoria. (2008). "Can Polling Location Influence How Voters Vote?". [Online] Available: <http://www.gsb.stanford.edu>
- [4] National Population Commission (NPC);: Population Census Data of Nigeria 2011. Abuja, Nigeria.
- [5] T. O. Idowu, "Estimation of the Quantity of Surface runoff to Determine Appropriate Location and Size of Drainage Structures in Jimeta Metropolis, Adamawa State," *Journal of Geography and Earth Science* Vol. I (1) pg 19-29. 2013, June
- [6] A. Aliyu , M. A. Shuabu and R. M. Aliyu "Mapping and spatial Distribution of Post Primary Schools in Yoa North Local Government Area of Adamawa State, Nigeria." *International Journal of Science and Technology*, Vol.2. Pg405-422 2013
- [7] J. Inobeme, A. K. Ayanwale. "An Assessment of the Spatial Distribution of Government Secondary Schools in Zaria Area, Kaduna State," *The Information Manager* Vol.9 (1) 2009
- [8] H. D.Musa and B. B. Mohammed." An Analysis of Spatial Distribution of Primary andSecondary Schools in Bida Town Nigeria." *Abuja Journal of Geography and Development* Vol.3. No.2. 2013