RESEARCH ARTICLE

DENSITY BASED CLUSTER IMAGE OF SELECTED OBJECTS OF INTEREST: A CASE STUDY OF AMUWO ODOFIN LOCAL GOVERNMENT AREA, LAGOS STATE, NIGERIA

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| Received | 30 September 2017 | | Accepted | 19 October 2017 | | Published 24 October 2017 |

ABSTRACT

Background: Density-Based Cluster is an unsupervised learning method that shows individual characteristics groups in a given data on the fact that a cluster in a data space shares a common region of either high, medium and low point density, separated one from other such clusters by sharing common regions of either high, medium or low point density. **Objectives:** This study aimed at investigating the density cluster image of selected physical feature/objects of interest and their locations of Amuwo Odofin Local Government Area, Lagos West Senatorial Districts, Lagos State, South Western Nigeria. Also, Seven (7) objects/Physical features and their location with their colour representation were determined using Google earth satellite imagery and they are; Bus Stop (Blue), Markets (Pink), Hospitals (Light Green), Hotels (Black), Schools (Deep Green), Churches (Red), and Banks (Brown). **Methods:** An unsupervised clustering technique was used for this study. The methodology adopted for this study was based on the use of Google earth imagery in determines the location and coordinate x, y of some objects of interest within the study area. Further analysis was carried out using ArcGIS 10.2 Software (Arc Map 10.2). **Results:** for this study, composite maps showing all the selected points of interest and map query for each object were presented to show the area covered by each feature selected. Also, from the result, the areas of Low, Medium/Moderate and high density were determined and it shows that mostly all the selected objects of interest were mainly at the upland part of the study area. **Conclusion:** The density map produced will go a long way in proper planning of the study area and also will help the Lagos State Government in planning and re-planning the area and also pave way for the private sectors to invest more in the area.

Keywords: *Image clustering, objects of Interest, unsupervised clustering Techniques, density map, Proper Planning*

1. INTRODUCTION

Cluster is way of collecting objects that are similar between groups of objects together and the one that are not similar to the objects belonging to other clusters. Generally, Image clustering is the application of cluster analysis in a way to support image. Clusters can be considered as districts in the data space in which the objects are closely together, and are separated by district of low object density. Clustering is a way of categorizing object with similar characteristics together. In data mining analysis, Clustering and Classification play an important role. Veyssieres and Plant (1998) suggested that in supervised learning approach, Classification is usually used and for unsupervised learning, clustering approach is used. Clustering aimed at describing how similar object are grouped together in particular domain, and that of classification is predictive [1].

A given counties, etc. Clustering method is widely used for data analysis and pattern recognition. An appropriate clustering approach should be allow for an important density variation within the cluster because, if homogeneous clustering is to go for, a large number of smaller unimportant clusters may be produced. The method of unsupervised clustering is crucial because it intends to organize dataset into different categories in relation to a distance. Application area of clustering can be found in image processing, pattern recognition as mentioned earlier, learning through machine etc.

There are two main categories of clustering namely; the fuzzy clustering in which data point can be part of many cluster and the second one is the hard clustering in which object point are separated into different clusters in different ways such as segmentation (Partitioning), ranking order (Hierarchical), grid based, model based and density based. Clustering categorized data into parts of the group in a way that object of the same instances are categorized together; separate instances belong to separate categories. Generally, Clustering is an unsupervised learning of great demand that aims at finding separate groups in data, known as clusters. Population in a Neighborhood can determine density. In addition, the density of a neighborhood can be defined as being low, medium/moderate and high. These three forms of densities can

be categorized according to area of land per population. Low density (less than 25 hectares per population), medium/moderate (between 25-60 hectares per population) while the high density (over 60 hectares per population). Objects within the neighborhood will be distributed across the area whereby some will fall in low, medium/moderate or high density.

Density-Based Clustering may be defined as an unsupervised learning method that recognizes individual characteristics groups in the data on the fact that a cluster in a data space shares a common region of high point density, separated from other such clusters by sharing common regions of low point density. Typically, the data points in the different regions of low point density are considered as noise.

Jain (2010) stated that in density-based clustering, clusters are defined as the region of higher density to that of the remaining data set. Density-based clustering is well known in data mining to classify a data set based on its density parameters, where lower density areas separate high-density areas [2]. Chen etal (2015) opined that clustering methods is one of the most popular algorithms in image segmentation domain. It is an approach of classifying patterns or data into categories, which is on the basis of the samples in the same group, have the higher similarities than the other ones in different groups [3].

The high and low density cluster were separated. Different colors correspond to different cluster. In Anna et al., (2010), it was stated that the most well known density based clustering method is DBSCAN and it is Similar to linkage based clustering; that it is based on connecting points within certain distance thresholds. However, it only connects points that satisfy a density standard, in the original variant defined as a minimum number of other objects within this radius. A cluster consists of all density-connected objects (which can form a cluster of an arbitrary shape, in contrast to many other methods) plus all objects that are within these objects' range [4].

In density based clustering, objects of the same group will be grouped together and are separated from other object from other group. Colour of the object differentiates one set of cluster of object from another. Image segmentation is a way of classifying an image into different categories. In MacQueen (1967) proceedings, he stated that Image segmentation using unsupervised clustering method was carried out using the K -means clustering algorithm [5] and the purpose of K-mean algorithm is to segment the area of interest from the background [6,7]. In Sezgin and Sankur [8], four popular approaches for image segmentation are: edge-based methods, threshold techniques [9], neighborhood-based techniques, graph-based methods [10], 11] and cluster-based methods. For the purpose of this study, the cluster based method was used.

In Banfield and Raftery (1993), Density-based methods assume that the points that belong to each cluster are drawn from a specific probability distribution [12]. Therefore, this study aimed at assessing the physical features/Object of interest present in Amuwo Odofin Local Government Area of Lagos State through the Google earth imagery Pro and location of area of low, medium/moderate and high density in cluster maps.

2. MATERIALS AND METHODS

2.1 Equipment Used (System and Selection):

System selection used for this study comprises of both the hardware and software.

2.1.1 Hardware: Hardware used for this study are;

- Laptop computer
- Hp LaserJet printer (for printing)
- External hard drive 32gigabites

2.1.2 Software: This study was carried out using the following software:

- Google Earth Pro Imagery 2015
- ArcGIS 10.2 (ArcMap 10.2) was used for GIS analysis such as spatial analysis and spatial search queries.
- Microsoft Word 2007
- Microsoft Excel 2007

2.2 Study Area: The study area for this study is Amuwo Odofin Local government Area, Lagos West Senatorial district, Lagos State South Western, Nigeria. It is located between geographical coordinate of Latitude 6° 27′ 0″ mN and

Longitude 3° 16′ 0″ mE. It covers a total land mass of about 100q.km, Two separate geographical spheres were within the area which are the Upland and Riverine areas with a total Population of about 318,166.

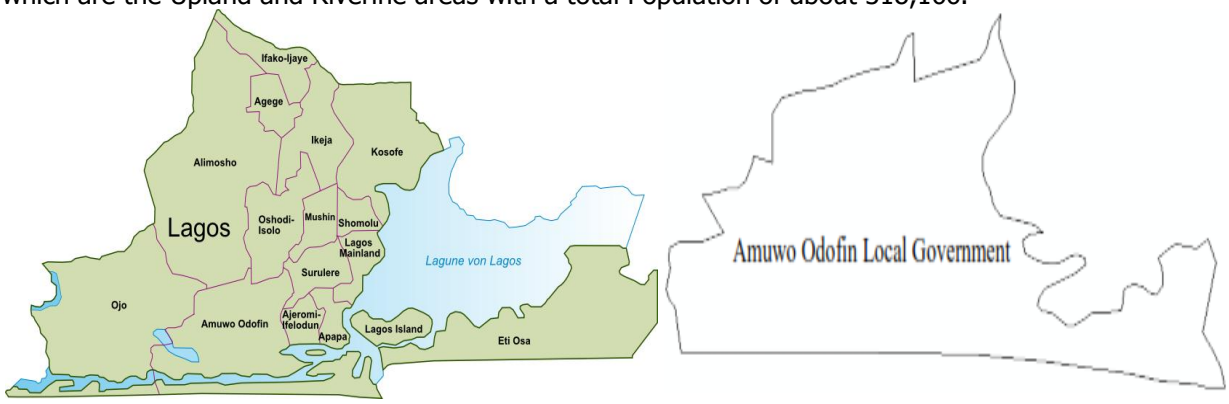

Figure 1: The figure presents the Lagos State map and Extracted Map showing Amuwo Odofin Local *Government.*

2.3 Method of Data Collection/Acquisition: The method adopted in collecting/acquiring data for this study was based on the use of remote sensing techniques (Google earth Pro) imagery in extracting the (X, Y) coordinates in geographic form and later converted to UTM coordinates (mE, mN) and the location of each point of interest in Amuwo Odofin Local Government. The Points of interest selected are; banks, schools, bus stops, churches, hotels, hospitals, market place. The data sorting was done for each object selected using excel spread sheet. Further processing was done using ArcGIS 10.2 (Arcmap 10.2) and the density cluster maps were produced. Below are the methodology work flows for the study.

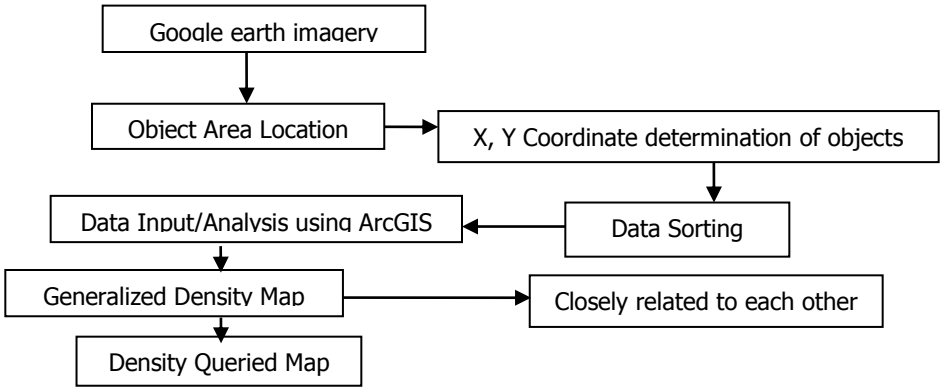

Figure 2: The figure presents the Methodology of the work flow for the study.

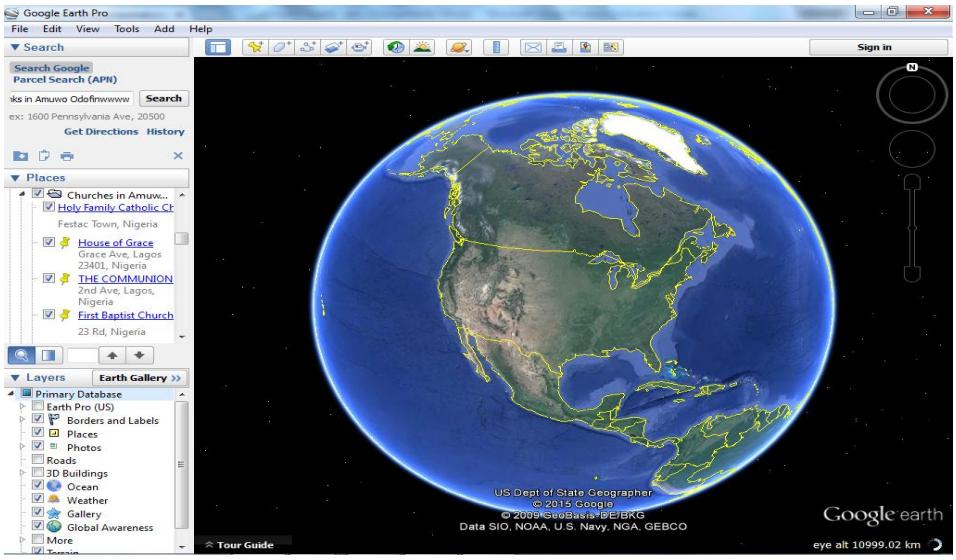

Figure 3: The figure presents the launch of the Google earth Pro Software.

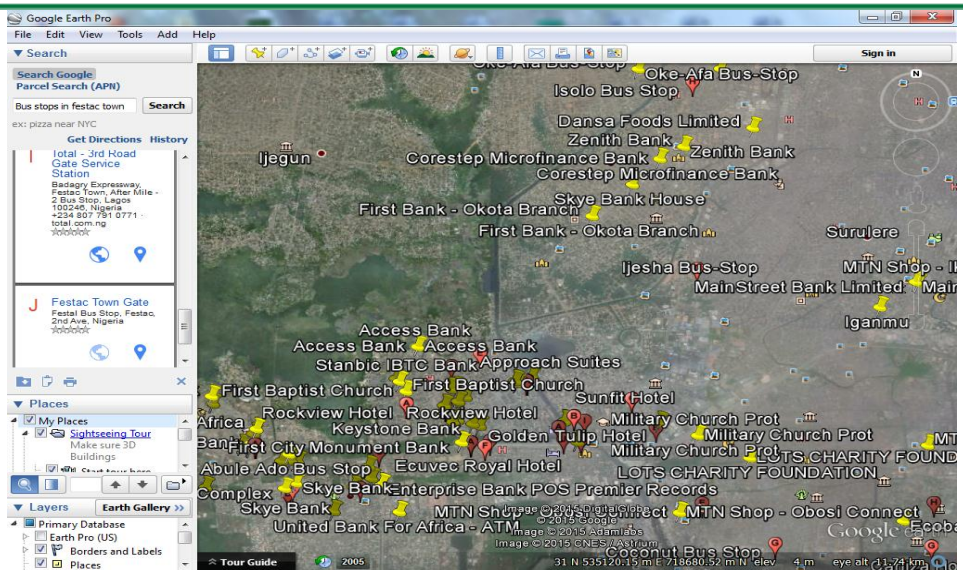

Figure 4: The figure presents the sample of data acquisition through the Google earth Software.

Table 1: The table presents the Sample of Excel sheet of selected bus stops.

	A	B	C
1	BUS STOPS	Eastings (m)	Northings (m)
2	Maza Maza Bus Stop, Lago	533595.26	714060.45
3	Isolo Bus Stop, Agbabiaka	535576.88	721705.48
4	Sunrise Bus Stop	535588.35	712163.93
5	Iyana Iba Bus Stop, Iba tov	522587.22	714158.65
6	Mile 2 Bus Stop, Lagos	534933.27	714330.55
7	Iyana Isolo Bus Stop, Isolo	537140.68	721969.82
8	Agboju Bus Stop, Lagos Ba	531634.24	714027.47
9	Cele Bus-Stop, Ikotun-Idir	531439.53	722863.06
10	Challenge Bus Stop, Agege	539208.6	722732.68
11	Maza Maza Bus Stop, Lago	533595.26	714060.45
12	Isolo Bus Stop, Agbabiaka	535576.88	721705.48
13	Bus Rapid Transit Station,	540651.14	721258.14
14	Oko Filling Bus Stop, Igan	527078.44	724348.93
15	Olorunsogo Bus Stop, mus	538983.76	722362.3
16	Trade Fair Bus Stop, satell	527200.84	713629.3
17	Abule Ado Bus Stop, satel	528331.12	713649.75

Sheet1

The shapefile of the boundary of Amuwo-Odofin was also acquired from other sources.

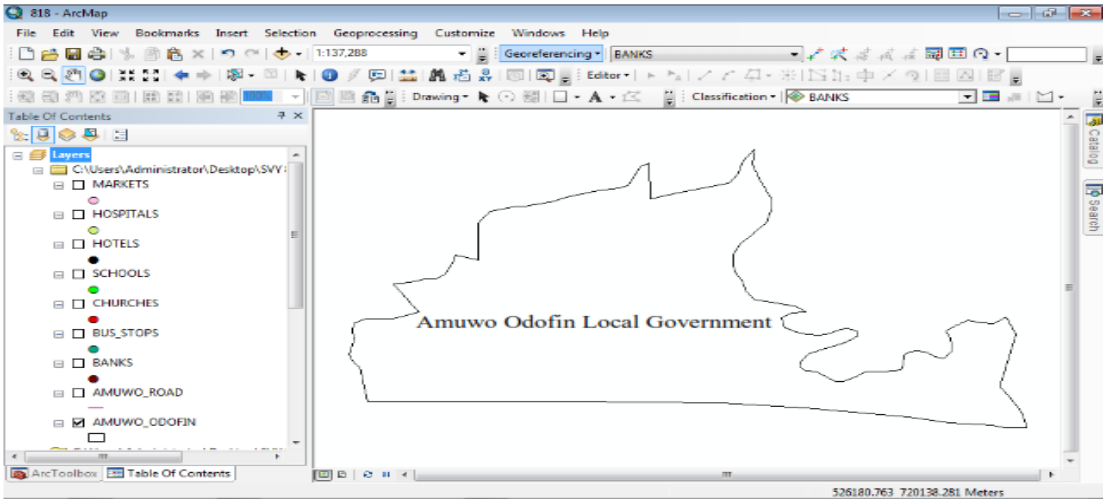

Figure 5: The figure presents the Shape file of Amuwo-Odofin L.G.A in ArcMap

2.4 Data Processing: For this study, three steps were involved in processing. The importation of map that is importing the base map into ArcMap environment, digitizing, that is creation of all shapefiles (layers) and database creation which involves creation of attributes table.

The excel sheets containing all the points were imported into ArcMap environment and were plotted as coordinates points and each object are represented with different colour within the neighborhood of the study area.

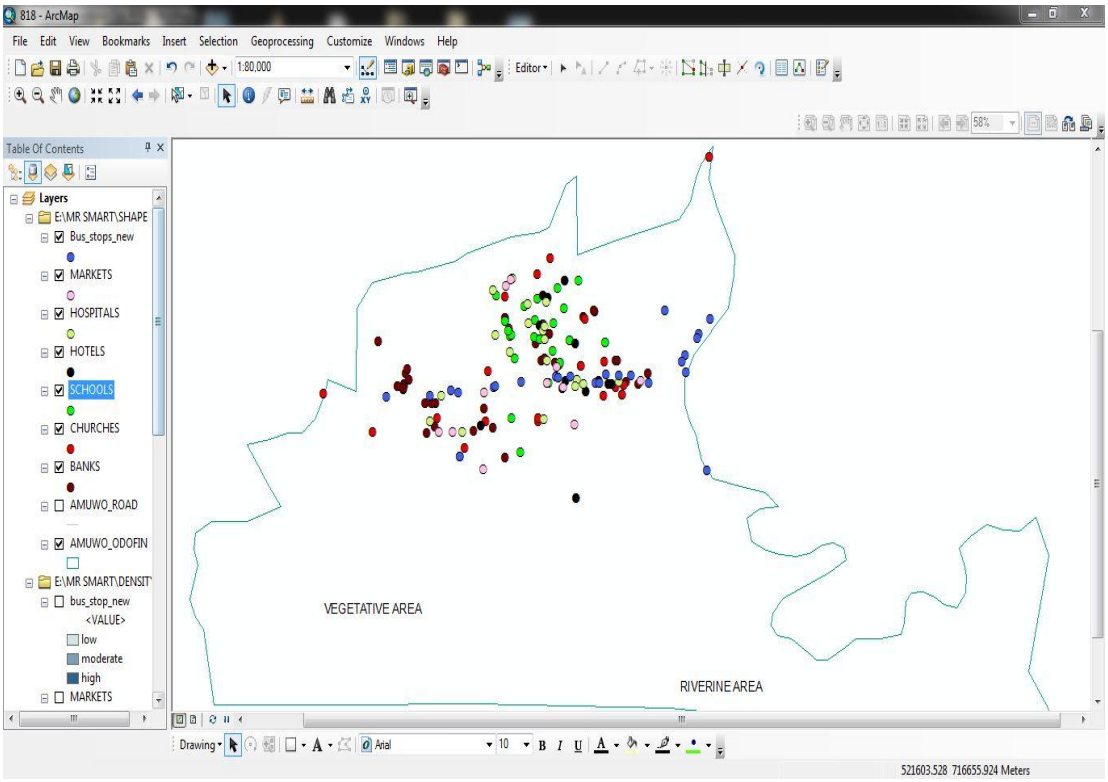

Figure 6: The figure presents the Points representing bus stops, banks, churches, hotels, hospitals, markets and schools plotted in ArcMap environment. The Riverine areas are the down side to the right while others are the vegetative area.

Point Density tool under the Spatial Analyst toolbox was used to create a raster density layer to the map. The magnitude per unit area from point features that fall within a neighborhood around each cell was calculated with point density interface of radius of 500km^2 (see figure 7).

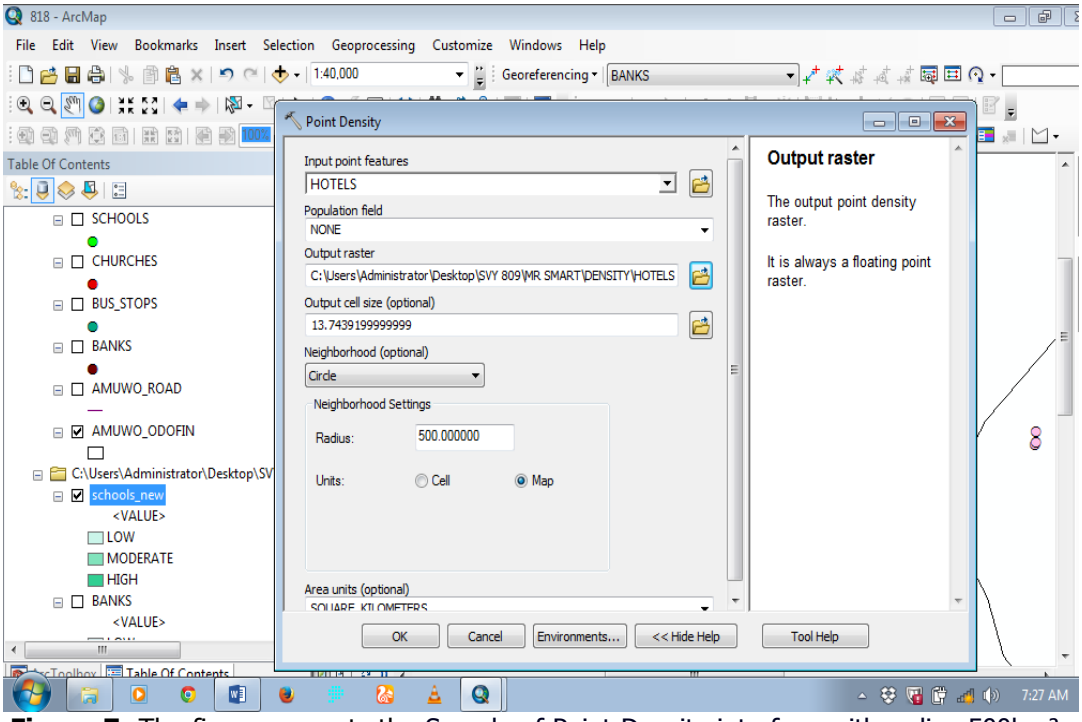

Figure 7: The figure presents the Sample of Point Density interface with radius 500km^2. (From ArcGIS environment).

3. RESULTS AND DISCUSSION

This is the stage where different analyses were performed on the data to produce desired result. For this study, composite map showing all objects of interest and map query for each object of interest were produced using ArcGIS 10.2 (ArcMap 10.2 Software), figure 8-15 display the results of selected objects within neighborhood of the study area. Figure 8 shows the composite map of all the selected object of interest, figure 9-15 shows the area of Low, Medium/Moderate and High density.

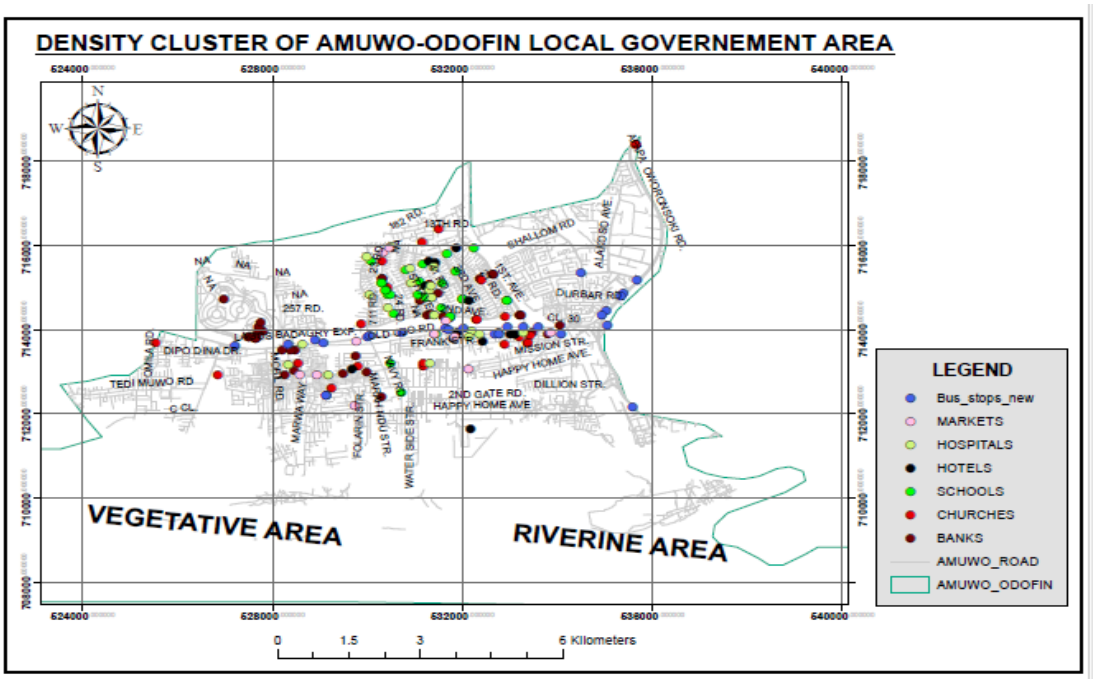

Figure 8: The figure presents the Composite map showing density map

Figure 8 above shows all the selected Objects of interest and their spatial locations. All selected features/Object were represented with different colour - Bus Stop (Blue), Markets (Pink), Hospitals (Light Green), Hotels (Black), Schools (Deep Green), Churches (Red), and Banks (Brown)

Area of Low, Medium/Moderate and High Density

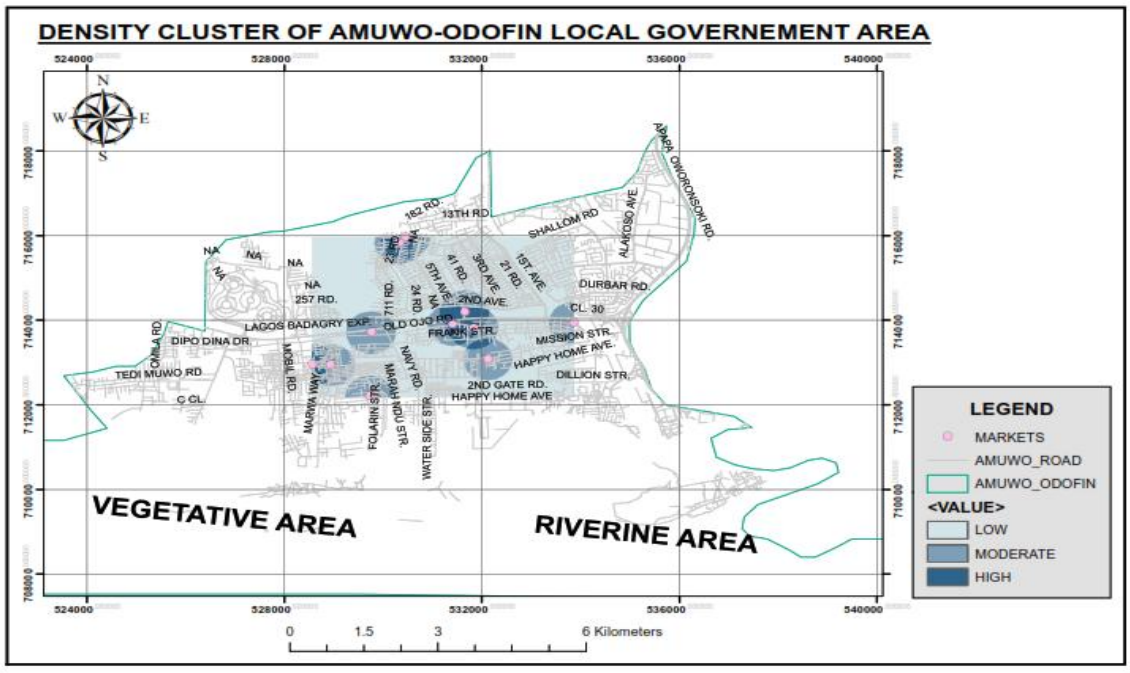

Figure 9: The figure presents the Density map showing markets with Low, Moderate and High point density.

From the figure 9 above, it shows that markets are much more concentrated in the medium/moderate area, few in the high and none in the low area (Medium>High>Low) which indicate that people living in the low density area must go and buy the needed item/goods in either of the medium or high density area.

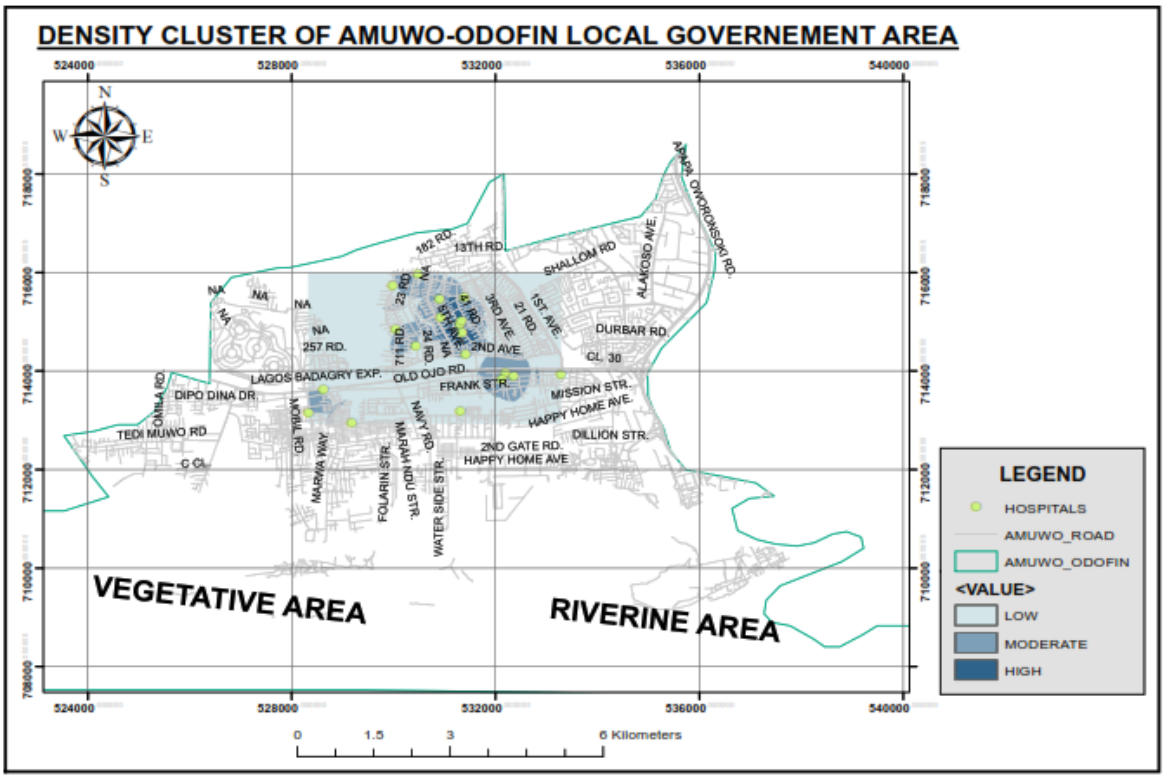

Figure 10: The figure presents the Density map showing hospitals with Low, Moderate and High point density.

From the figure 10 above, it shows that hospitals are much more concentrated in the medium and high area than the Low. (Hospital - Medium, High>Low) which indicate that people living in the low density area must go in case of emergency to either medium or high density area to receive medical services/attention.

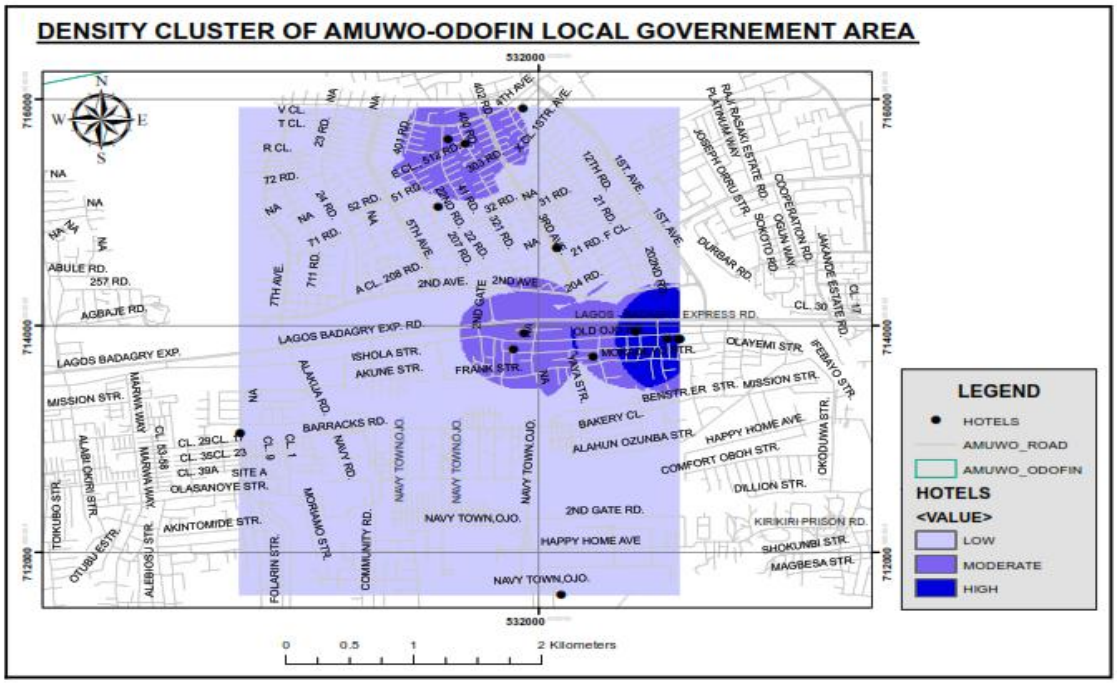

Figure 11: The figure presents the Density map showing Hotels with Low, Moderate and High point density.

From the figure 11 above, it shows that few Hotels are equally distributed within the medium and low than the high area (Medium, low>High) which indicate the need for more Hotel/resting house in all the density areas because few Hotels were located within the study area.

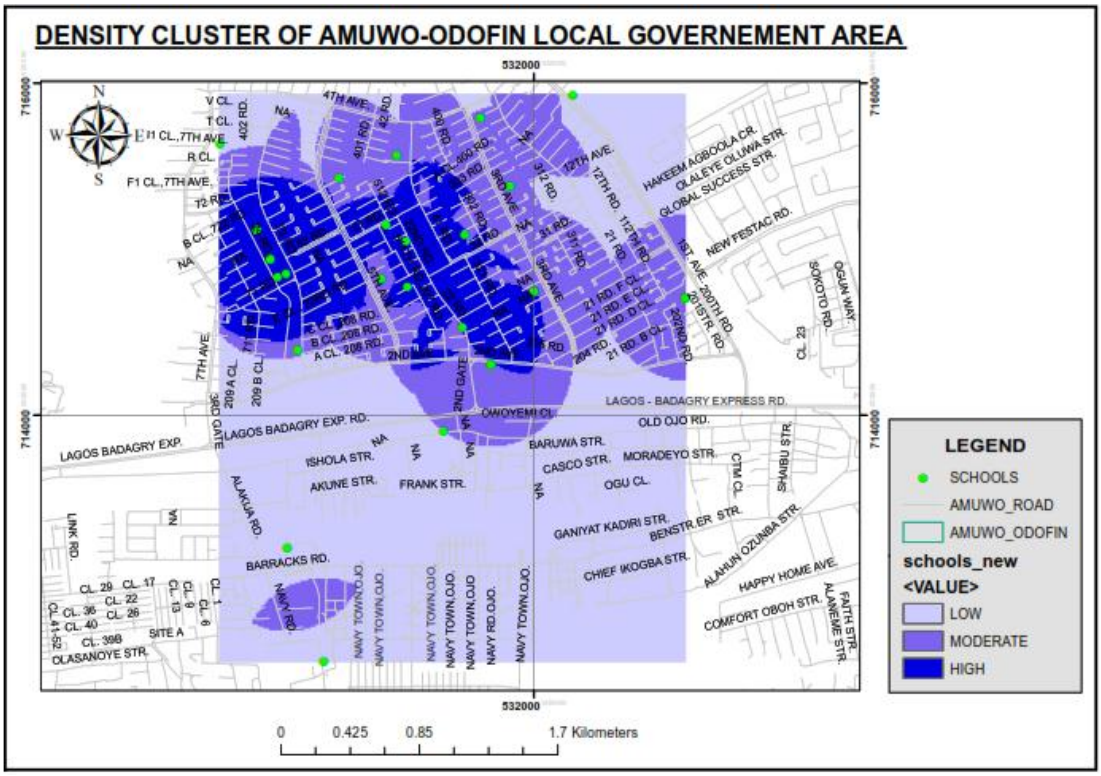

Figure 12: The figure presents the Density map showing schools with Low, Moderate and High point density.

The above figure shows that Schools are much more concentrated in the High, Medium area than the Low area. (School - Medium, High>Low) which indicate that more schools be built in the low area because of the less priviledge ones.

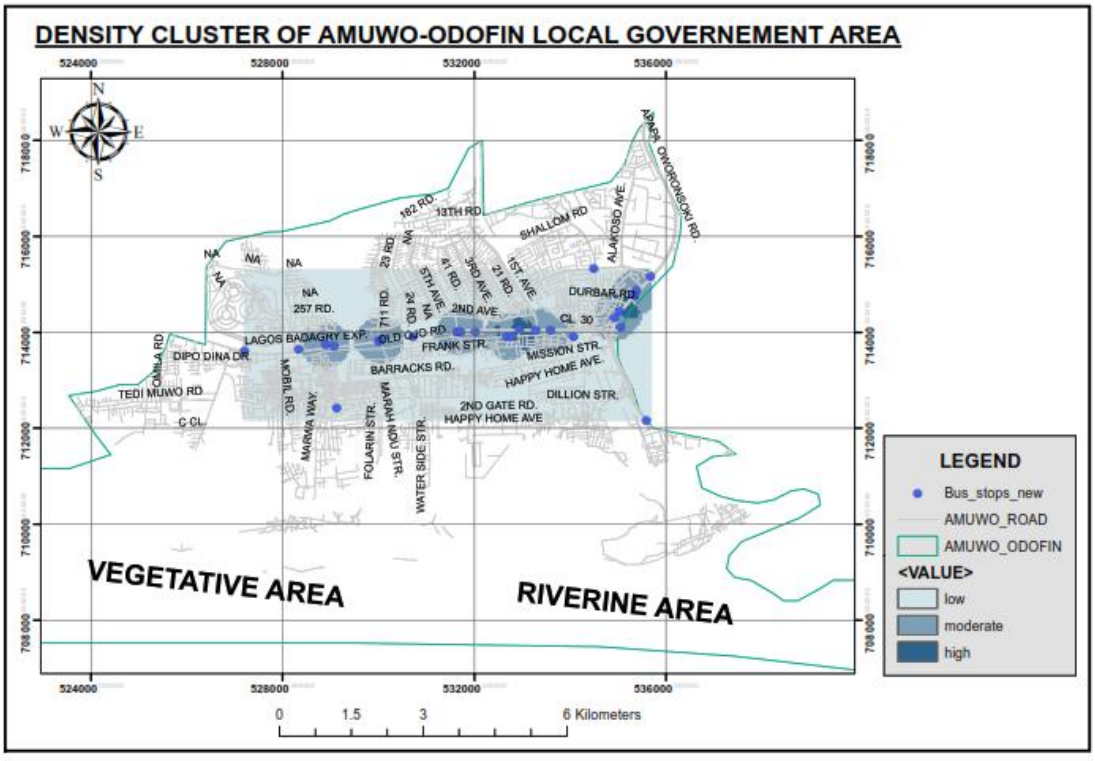

Figure 13: The figure presents the Density map showing bus stops with Low, Moderate and High point density.

Figure 13 above shows that bus stops are much more concentrated in the medium area than the low and high area. (Bus Stop – Medium> Low, High) which indicate that more bus stop be created in the low and high area for easy transportation from one place to the other.

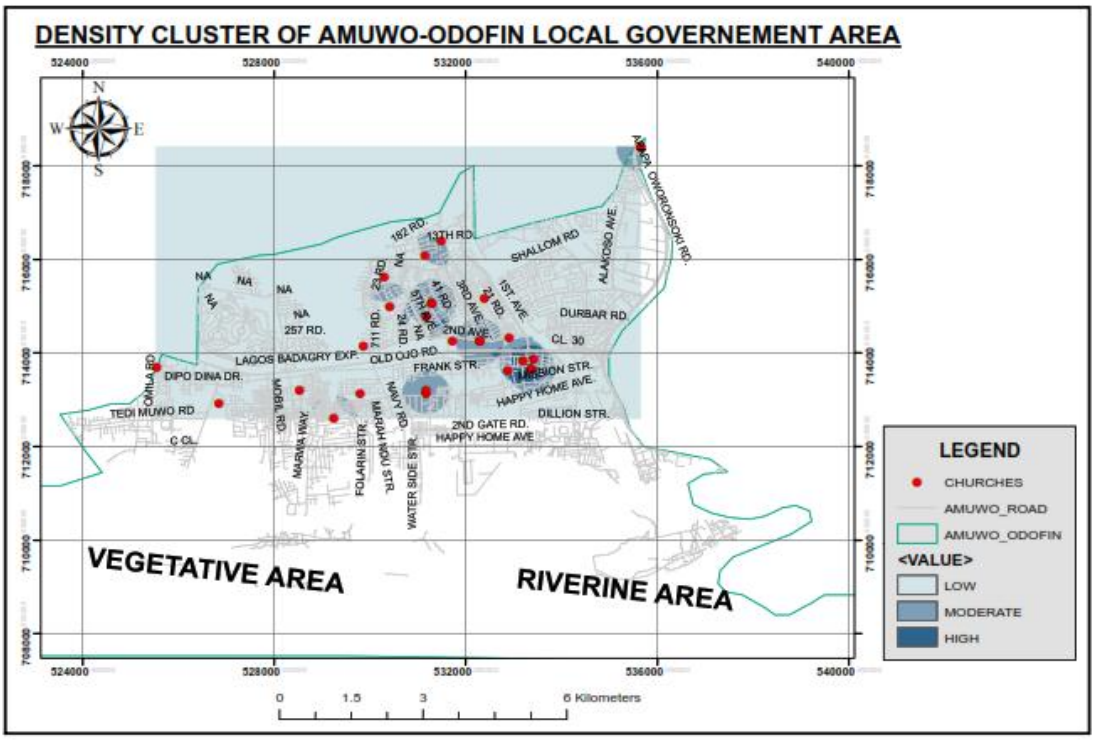

Figure 14: The figure presents the Density map showing churches with Low, Moderate and High point density.

Figure 14 shows the spatial location of Churches and also shows that more Churches were concentrated in the low and medium area than the high area. (Churches – Low, Medium>High) which indicate that more Churches be built in high area.

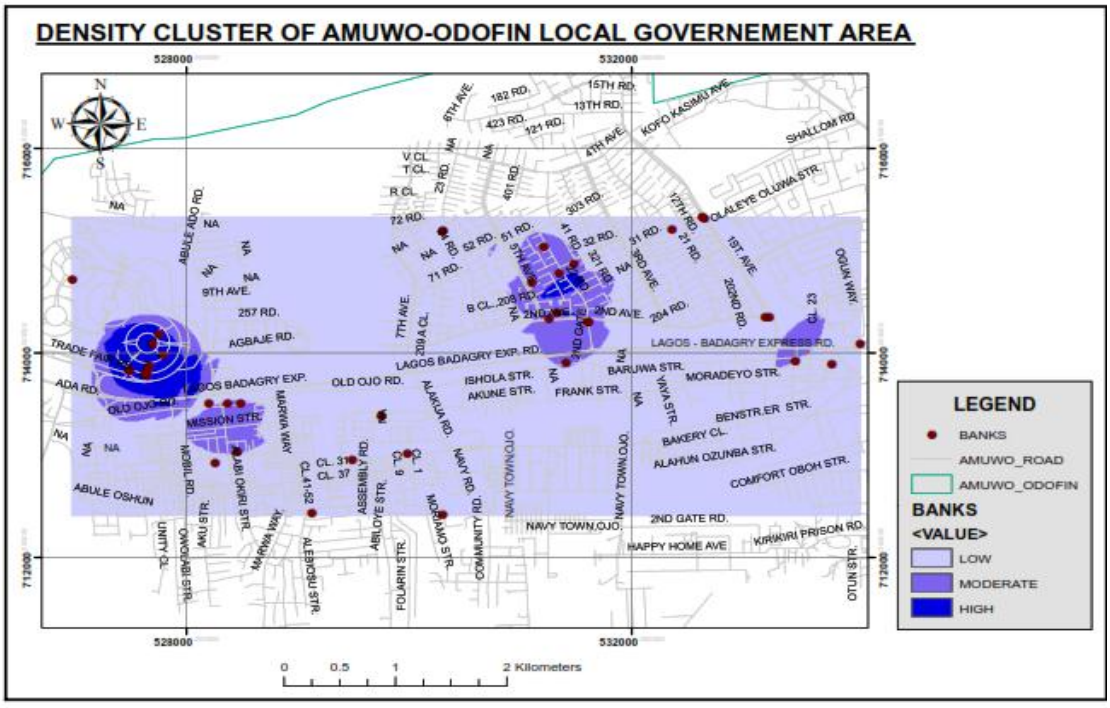

Figure 15: The figure presents the Density map showing Banks with Low, Moderate and High point density.

From Figure 15 above, the spatial location of banks were shown and it indicates that more banks were located in the Low and Medium/Moderate area that the High area which indicates that more banks should be built in the High density area.

4. CONCLUSION

This study has revealed the location of selected points/objects of interest in Amuwo Odofin L.G.A, Lagos State, Nigeria using Google earth satellite imagery and GIS application software (ArcGIS 10.2). The finding shows the selected objects along their spatial locations and the density area where they are. It also shows that major objects selected falls within the Medium/Moderate and Low density area and few objects fall within the high density area. The objectives of this study have been achieved. The queries performed made the GIS to answer user-specified questions. From the results obtained it can be concluded that:

- All the selected points of interest were located at the upland area of the study area.
- Only in the vegetative and the riverine areas shows no point of interest.
- Tourist and the neighbouring people will be able to locate the area they are going and the area where infrastructures they needed are.

Recommendation

It is recommended that the government of Lagos State look into the study area and create more infrastructural facilities so as to enable development and also bring private investors to invest to the Local Government area so as to improve the way of life of the general populace of the area. Also, the vegetative and the riverine area should be developed with infrastructures so that they can looks like the other places within the study area.

5. REFERENCES

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Cite this article: Gbola Kehinde Adewuyi, Martins Adewale Oyekola, and Stephen Adediran Aderinkomi. DENSITY BASED CLUSTER IMAGE OF SELECTED OBJECT OF INTEREST: A CASE STUDY OF AMUWO ODOFIN LOCAL GOVERNMENT AREA, LAGOS STATE, NIGERIA. *Am. J. innov. res. appl. sci.* 2017; 5(5): 326-335.