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TSO3B : REMOTE SENSING FOR LAND USE AND PLANNING _ 6388

Assessment of Urban Development Planning using Supervised Classification of remotely sensed Imageries and GIS, A Case study of Independence Layout (Part of), Enugu, Nigeria.

Nnam, Victor Chukwuemeka, victor.nnam@gmail.com;
Nnam, Godwin Uchechukwu., u_nnam@yahoo.com and
Nnam John Okwor, john_nnam@yahoo.co.uk

GeoSynergy Services Limited. Suit C2 Goshen Plaza, 38 Garden Avenue, Enugu, Nigeria

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1.0 SUMMARY

Adequately planned urban development is a key to achieving sustainable environment. Urban planning therefore becomes important as we develop our urban areas. For us to maintain the land use allocation pattern/scheme of our urban areas, we need to assess, monitor and control the trend and the pattern of development as they occur as uncontrolled development (slum developments) may mar the beauty and sustainability of the urban Area. This paper focuses on assessing and analyzing urban development using Object Based classification of remotely sensed satellite imageries of part of Independence Layout, Enugu urban, Enugu State, Nigeria. Using the Object based classification, a supervised classification of urban structures and other recent physical developments in the study area were achieved. Comparative Analyses were carried out between the classified image of Independence layout Enugu and the original Town Planning design in order to determine the difference between current land use pattern of independence layout Enugu and what it was designed to be. A Quickbird image of 2012 and the original town planning design of Independence Layout were used as primary data; Erdas Imagine 9.2 was used for the object based image classification while ArcGIS 9.3 was used for the analyses. The results show the spatial, graphical (map) as well as statistical analyses of recent developments and changes in the design of the study area. The results of this study are relevant in development control by governmental authorities across the globe.

Keywords: Urban development, Supervised Classification, Remote Sensing, Geographic Information System.

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2.0 BACKGROUND

- This paper is focused on a very vital study. In this study, urban development in Independence layout, Enugu, Nigeria was assessed using its original town planning design and an object based supervised classified remotely sensed imagery of its present state of development.
- Geographic information system (GIS) is a computer aided system which is designed and assembled to capture, store, manipulate, analyze, manage, and present many types of geospatially referenced data.
- Remote Sensing is the process of obtaining information or carrying out observations on an object without making any physical contact with the object. This is done using what are called sensors. The major process involved in extracting this information from the remotely sensed image is called image classification



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3.0 STUDY AREA

Independence layout is located at a pivotal part of Enugu metropolis; it is a low density part of Enugu urban, Enugu state, Nigeria (See Figure 1.0 below). it is in Enugu North Local Government Area of the State. It has an area of about 200Hectres and a population of up to 120,000 residents.

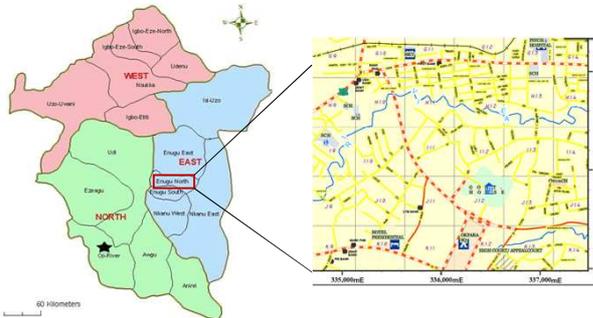
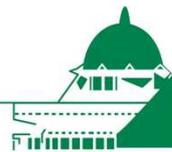


Figure 1.0: Map of Enugu state highlighting Enugu North and Independence Layout



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4.0 DATA

The primary data used in this study were ;

1. A hard copy of Independence Layout town planning Design.
2. A high resolution Quickbird imagery of 2011 covering the study area.

The secondary data includes;

- I. The ground coordinates observed for georeferencing as well as those observed during ground truthing.
- II. The attributes of the classes and the shapefiles gathered from the field using forms.

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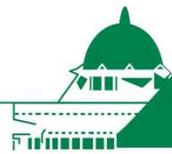
5.0 METHODOLOGY

- Scanning and Georeferencing of the Original Town Planning Design into picture format.
- Creation of Shape files for different land uses and the Vectorisation of the Design.
- The current land use was also vectorised from the satellite imagery and information about their uses were sourced from the field .
- The image segmentation was carried out on the image using user defined constraints which controls the segmentation of different image objects into independent objects.
- The image objects were diligently trained before the actual supervised image classification. In the classification process, classes were assigned to the image objects as well as the different land uses.
- the classified (current/actual use) image was overlaid on the vectorised original design of the study area

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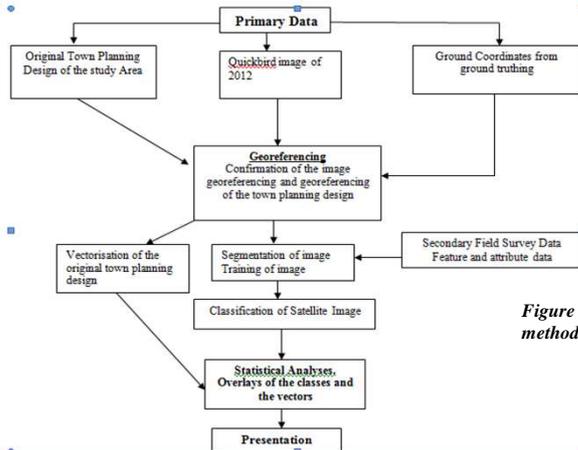


Figure 2.0 The work flow diagram of the methodology of the study.

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6.0 RESULTS

This study was able to achieve the following end results;

1. A vector map of the original town planning design of the study area.
2. A vector map of the present land use pattern in the study area.
3. A classified raster image (2011) of the study area.
4. Statistical analyses (pie charts) showing changing in the designed land use and the actual land use.
5. Overlays and comparative analyses between the actual land use and originally designed land use.

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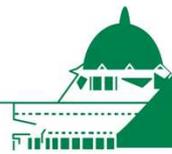




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7.0 Analyses of Results

7.1 Analytical step one : Statistical Analyses

These analyses evaluate the degree at which land uses and purposes vary between the original design and the actual use. If the sectors of the pies be observed diligently, it is clear that the sector for residential purposes in the design is larger than the sector for residential purposes in the actual use, this shows that the government is acquiring more land in that area as a result of increased government activities there. We can also observe a reduction of open spaces between the original design and actual use, which means that some open spaces are being subdivided for other purposes. The pies show a great variation between the design and the actual use. See figures below.

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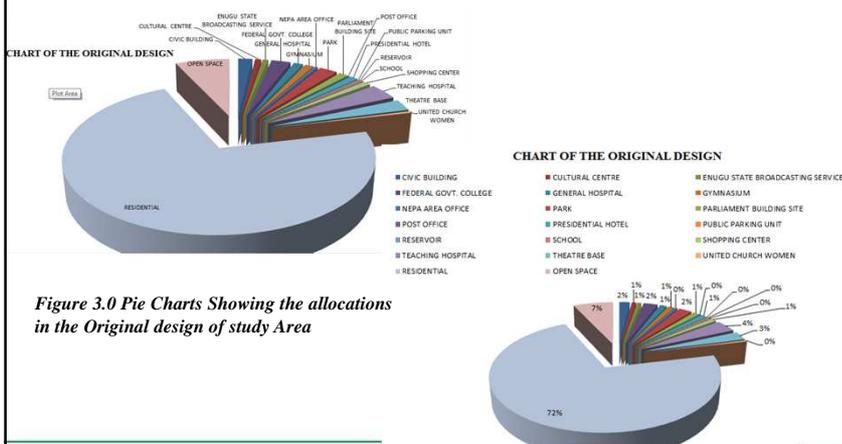
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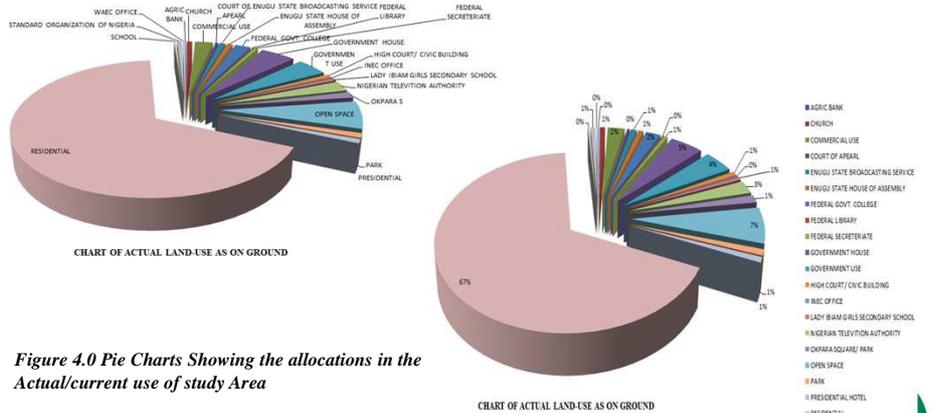




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7.2 Analytical Step two: Comparative Analyses between design and actual use

In this analysis, it can be observed that many blocks have been converted to uses other than the designed. For example, different land uses as can be seen in the block verged with a green line which was formerly reserved for Teaching hospital which have been subdivided into residential blocks; other places such as the General Hospital (Verged Orange), Public parking spaces (verged brown), Shopping Centre (Verged Milk colour) have been converted to government offices. Most of the open spaces have been converted to residential areas as we can see in area verged yellow (Open spaces) over brown classes (Buildings). See figure 5.0 below



Figure 5.0 Comparative analyses between the vector of the land use design and the classified image of the current use.

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7.3 Analytical step three: Development Controls in the Study Area

This analysis was carried out in order to assess the degree of development control in the study area. If the Vector/Raster overlay in figure 6.0 is observed, it will be noticed that the road network design have been altered to a great extent particularly in the southern part of the study area. From the classified raster, it will be noticed road network is narrower than the originally designed road width; this indicates that developers encroach into public lands and roads. This may be as a result of little or no development control; the problem stem from the institutional organization of urban planning in Nigeria and such leads uncontrolled development.



Figure 6.0 Developments in the study Area.

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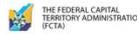
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8.0 CONCLUSION

In conclusion, this study is timely and relevant considering the present land reform issues in Nigeria. The study has highlighted the benefits of assessing urban development using supervised classification of remotely sensed imageries and GIS. The methodology demonstrated in this study can be applied by the town planners and lands officers in development control, urban planning, land allocation, re-allocation, etc. This method employs a quick and cost effective way that underscores its advantages over the traditional methods of town planning and development control currently being applied in the study area currently.

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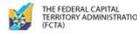


9.0 CONCLUSION-DISCUSSIONS

So many observations have been made in this study and salient issues were noted. The research team deemed it necessary to discuss the following points as regards the application of this study;

- Urban development in Nigeria should be assessed from time to time as well as Town planning designs updates using the methods demonstrated in this study. This is because it was observed that there was no update in the planning design of independence layout scheme since the first design was made.
- Proper measures should be put in place by the appropriate Government Authorities in order to enforce development controls. This is because little or no development controls were observed in the study area.
- New layouts should be planned by the Government and communities in undeveloped areas instead of mutilating or further subdividing the already planned areas. These practices may turn planned cities into slums.
- Surveyors should insist on government approved town planning designs/schemes before carrying out any cadastral or layout survey for any client.
- It was observed that the problems of urban planning in Nigeria stem from the Land tenure system; that is what differentiates the implementation of the Land Use Act in the Northern Nigeria and that of the Southern Nigeria. Land tenure system remains a barrier to the institutional context of urban development planning and control in Nigeria.

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