GEOMATICS TECHNIQUES FOR LANDUSE PATTERN IDENTIFICATION IN APATAPITI SUBURB OF AKURE METROPOLIS, ONDO STATE NIGERIA

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Abstract

This paper examined the use of the techniques of geomatics to identify the landuse pattern of a typical suburb of a metropolis. The chosen suburb is North Eastern part of Apatapiti community in Akure metropolis, Ondo State Nigeria. Global Positioning System (GPS) techniques was used to establish controls points around the project area to serve as a framework for the project. 2-D geospatial data of the features existing on the study area were acquired using the Total Station instrument to determine their planimetric positions in space. The planimetric positions were plotted using the AutoCAD 2007 software on a scale of 1:1500 to obtain the layout plan. Opinions of the residents through one-on-one interviews, physical observations and acquired geo-spatial data were combined to analyse the landuse patterns through Tables and Charts using the Microsoft Excel software. Findings revealed the problems of poorly constructed temporal and permanent features in the community, absence and inadequate roads, drainages and other social amenities. Results obtained from the analysis of the landuse showed that the layout is 61% residential, 29% commercial, 7% agricultural, 2%social and 1% educational. The effectiveness of Geomatics technique as a tool for effective mapping of small urban area was the conclusion of the project work. The study recommended the involvement of the geomatics community in the actualisation of future cities through mapping of the suburbs; yearly update of the work to help the community to know the spatiotemporal dynamics of the landuse for faster and efficient development; and the adoption of the study as sufficient for a Land Information System (LIS) applications and database creation for the community.

Keywords: Geomatics, Geospatial data, Landuse, Mapping, Suburb

1.0 Introduction

Geomatics has been a discipline that is as old as man (Gomorasca, 2009). Man has been blessed with an innate quest to understand his environment and solving its attendant problems (Ogunlade, 2018). This has led to a growing and metamorphosing technique of gathering, storing, processing, and delivering earth related information. It is used for mapping features on the surface of the earth. From the primitive and limiting nomenclature of land surveying through Surveying and Geoinformatics, the advent of and advancement in science and technology, computer and information systems, has brought about the all encompassing, interdisciplinary field of geomatics otherwise called geospatial technology (Ghilani and Wolf, 2013). It is a technology used for visualization, measurement, and analysis of features or phenomena that occur on the earth (GIM, 2018). Geomatics has been tagged the bedrock of all meaningful development, and maps have always been a major end result of most geomatics operations (Ghilani and Wolf, 2013).

Hemakumara, GPTS, and Rainis, Ruslan (2015) defined a suburb as a mixed-use or residential area, existing either as part of a city or urban area or as a separate residential community within commuting distance of a city. These are areas that accumulate to an urban area, hence the victim of growth and development. Oyinloye, 2010 remarked that cities are places where the alteration of the environment happens, and the main actors of these alterations are the suburbs. The challenges of landuse in the suburb is a prominent phenomena which is major factor that determines the transformation and evolution of the metropolis (Imimole, 2005).

1.1 The Problem

Information rules our modern world. We are in the era of vast information about our ever dynamic world (Wolf and Ghlliani, 2013; Ogunlade, 2018). Good as this may be, it is worrisome that the residents of the North Eastern part of Apatapiti community lacks adequate information and awareness on what type of natural and artificial features exists in and around them. There has been no record of comprehensive mapping carried out nor any available detail plan produced for the community. Hence there exist no baseline for development in such a community that is a suburb of Akure Metropolis which according to Oyinloye (2013), Owoeye and Ibitoye (2016), Ogunlade (2018), Owoeye and Akinluyi, (2018), is fast, sporadically and incessantly transforming. This suburb is replete with poorly constructed temporal and permanent features of social and infrastructural amenities. The identification of the pattern of this community's landuse is considered a valuable tool for sound policy decision making, controlled and guided spatial expansion and a proper utilization of the land resources. The use of geomatics techniques to identify this pattern became inevitable to prepare the community for the imminent transformation.

1.2 The Study Area

North Eastern part of Apatapiti community is located at the south gate of Federal university of technology (FUT), in Akure South Local government area, Akure, Ondo State, Nigeria. It is bounded by latitude 07^0 17' 29''N, longitude 05^0 08' 45''E, latitude 07^0 17' 31''N, longitude 05^0 09' 03''E, latitude 07^0 17' 18''N, longitude 05^0 09' 03''E and latitude 07^0 17' 21''N, longitude 05^0 08' 47''E. Apatapiti community is bounded by FUTA South gate area towards the North, by FUTA main campus towards the West, Aule community towards the South and Alaba layout towards the East. Apatapiti community can be accessed through FUTA South and West Gates or through Alaba layout and Aule village (Ogunlade and Tijani, 2016).

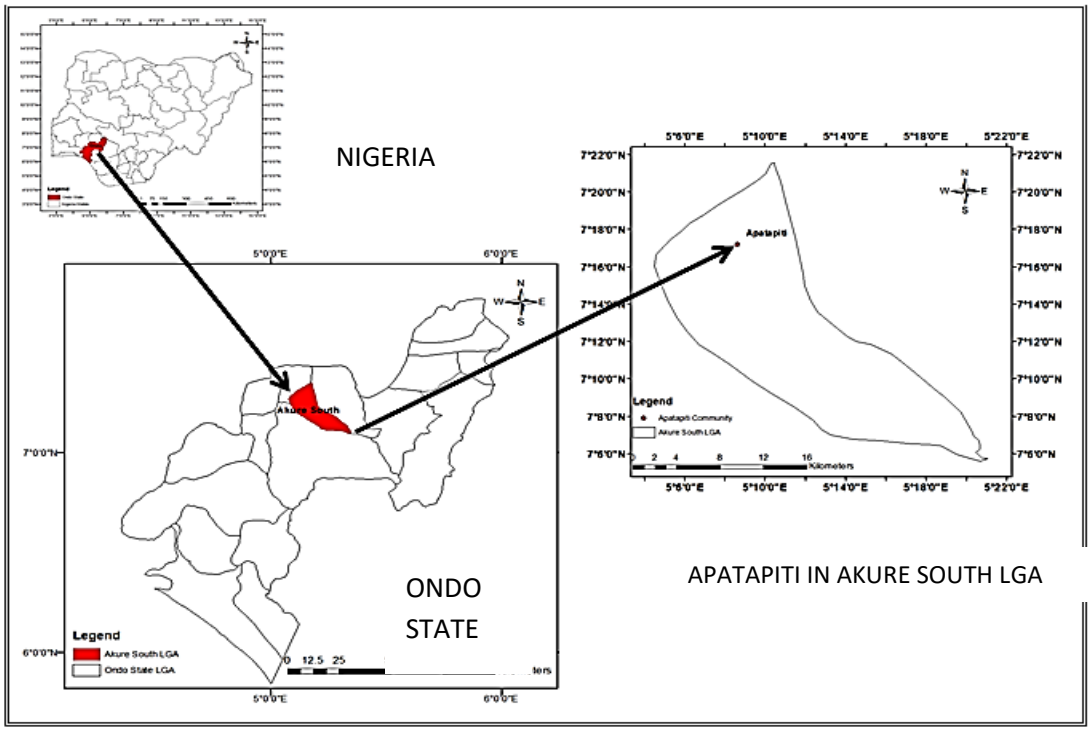

Figure 1: Map of the Study Area

2.0 Material and Methods

Many visits (reconnaissance) were made to the site so as to have a walking knowledge of the terrain, the people, the land use types and various conditions in operation there. Awareness was created to the residence on the proposed project and their necessary imminent assistance through one-on-one contacts, fliers and public address as opined by CAE and Barnebee (2017). This social geomatics was done for about four weeks before carrying out other procedures of geo-spatial data capturing. It was easy to do since the residents are enlightened people who are mostly employees or students of the near-by University. The positions of ground points to be used in the geo-spatial data capturing were determined and the mode of connecting the to-be-captured geo-spatial data to existing national geo-spatial grid was decided. The type of geomatics technique, the methodology, the procedure to be followed, the equipment and personnel needed together with the timings of the project were all decided through these visits, some right there on the field while some were decided in the office. A walking sketch (reconnaissance) diagram was drawn alongside the visits to assist in proper planning and decision-making.

On the field, Differential Global Positioning System(GPS) method was used to transfer national geo-spatial grid (controls) to three points named FUTA GPS 1, FUTA GPS 2, and FUTA GPS 3 (Figure 2) from a first order control point A72S . The three points were used as the ground control points for the data acquisition. Fourteen ground points were established around the suburb to delineate the perimeter. A Leica TCR 307 Total station instrument was used to obtain the coordinates of the ground points through a closed traverse method. All the details within the study area and other ground points were captured and coordinated from the perimeter points using the radiation method.

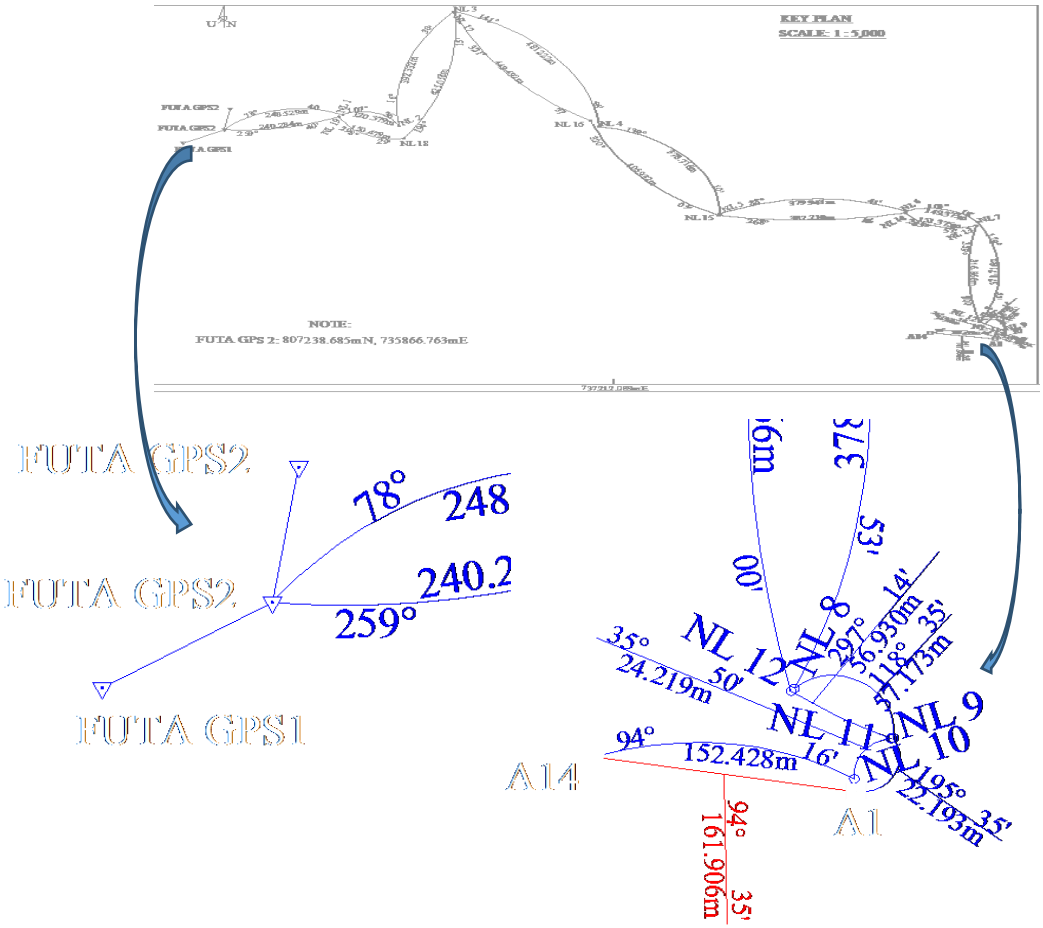

Figure 2: Plan of Transfer of Controls

Thus, the 2-D geospatial data of the perimeter points, the boundaries of land use types and the features existing on the study area were acquired using the Total Station instrument to determine their planimetric positions in space. A progress sketch drawing

was drawn alongside the data capture to help in regular check and update on the field and latter in the office.

In the office, the planimetric positions were downloaded from the Total Station instrument using Leica downloading office software and these data were exported into Auto Cad 2007 software. The data were plotted on a scale of 1:1500 to obtain the layout plan of the study area (Figure 3).

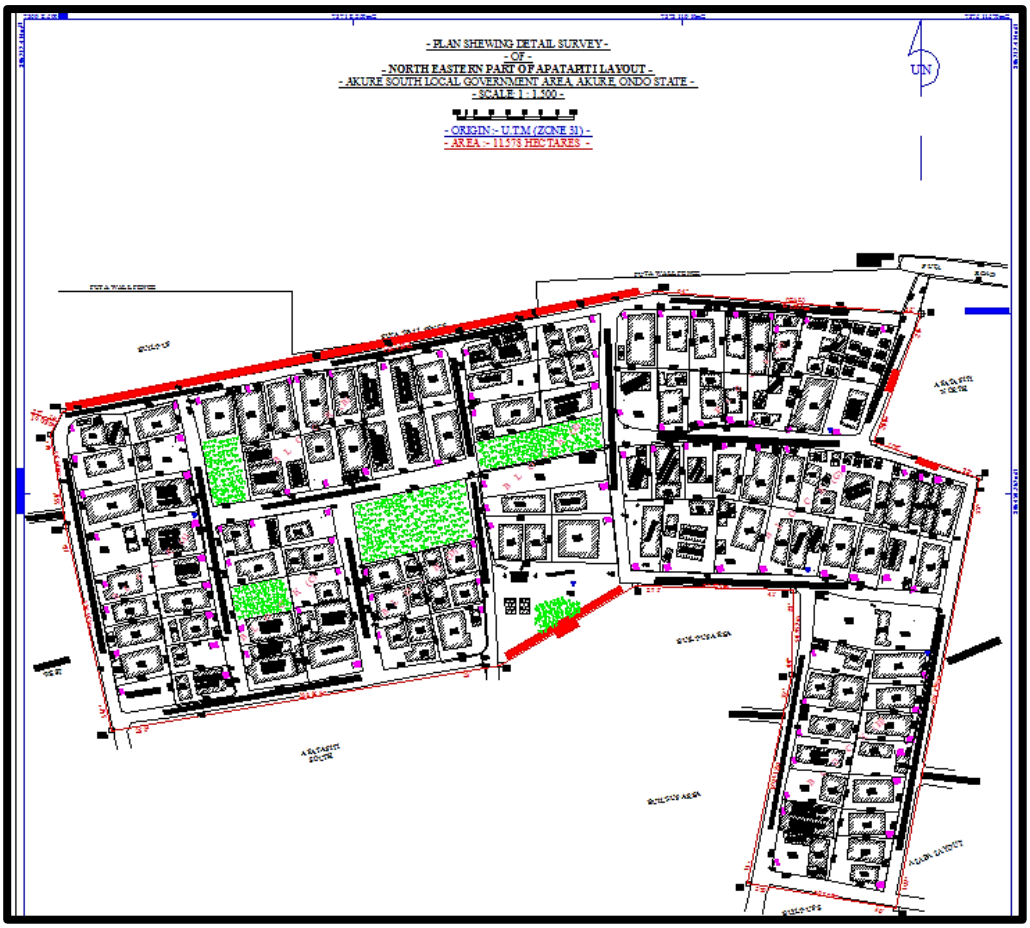

Figure 3: Layout Plan of the Study Area

The layout plan showed the delineation and demarcation of the perimeter of the study area and each landuse type, and the location of other details within it (Figure 4). These details are interpreted in the legends table (Figure 5). The total areal extent of the study area was determined and the area of each of the landuse activities were derived from the layout plan. These were made possible through the reconnaissance diagram drawn during the preliminary survey that ensured familiarity with the study area, the progress

diagram during data capturing that ensured regular update and checks and one-on-one interviews of the residents of the community that ensured proper information about the land uses in the community.

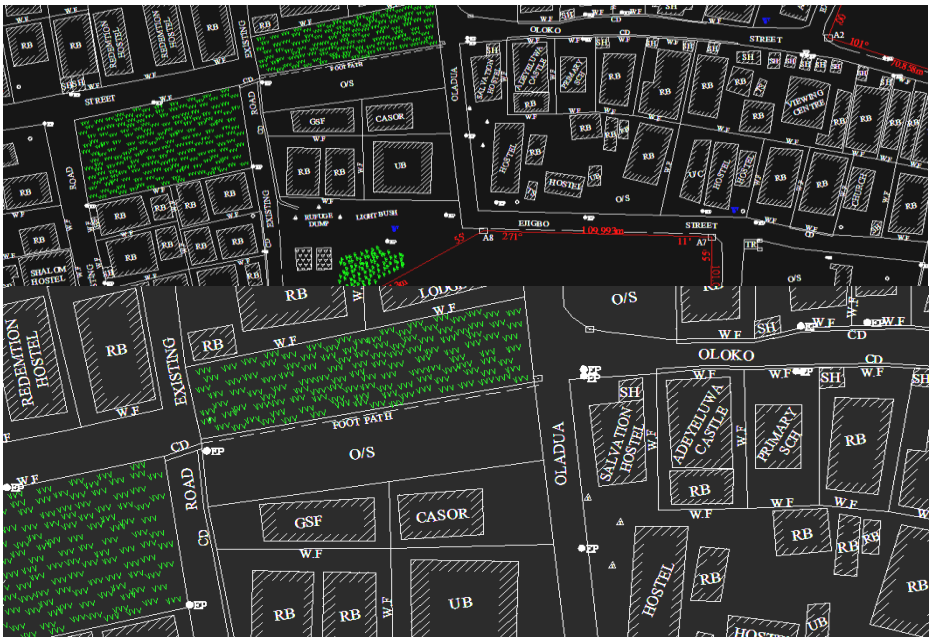

Figure 4: Portions of the Perimeter, Details and land use types in the Study area

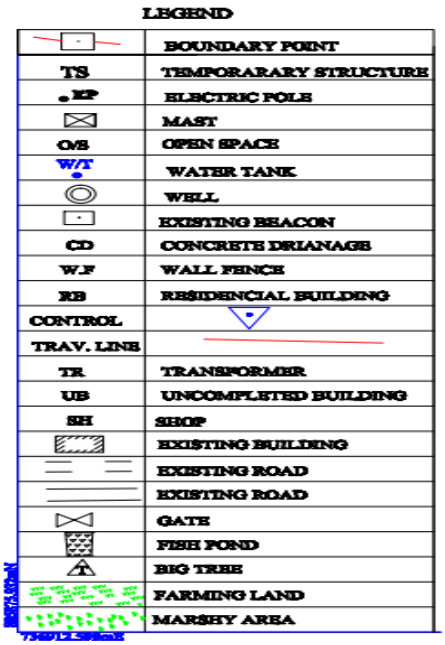

Figure 5: Legend Table in the Layout Plan

3.0 Results and Findings

From the layout plan (Figure 3) a total area of 11.587 hectares of land was covered in the mapping and from the field record a total of 442 features were captured (Table 1) by their 2-D geospatial data. A sample geospatial data record is shown in Table 2.

Table 1: The features captured

S/N	FEATURES	NUMBERS
1	Residential Buildings	126
2	Temporary Structures	8
3	Uncompleted Buildings	13
4	Existing Buildings	141
5	Shops	51
6	Transformer	2
7	Water Tanks	5
8	Well Water	12
9	Fish Ponds	2
10	Electric Poles	64
11	Farm Land	4
12	Trees	6
13	Mast	1
14	Refuse Dumping site	2
15	Existing survey beacons	5
	Total	**442**

Table 2: Sample 2-D Geospatial Data

Point	Easting(m)	Northing(m)
FUTA		
3	735879.949	807308.688
PEG1	736110.448	807287.495
A8	737197.291	806350.993
N18	737127.265	806341.770
N19	737102.057	806453.498
N20	737023.499	806434.844
N22	737046.603	806322.370
A9	736967.527	806309.253
N23	736950.025	806391.683

Seven land use types were envisaged during the reconnaissance. The landuse pattern in the study area showed that out of the seven landuse types envisaged in the study area, only five were prominent. These are: Educational, Commercial, Residential, Agricultural and Social land use types. Industrial and Recreational land use types were absent. The areal coverage of each landuse type are presented in Table 3

Table 3: Land Use Areal Coverage

Land Use Type	**Coverage (ha)**	**Percentage %**
EDUCATIONAL	0.116	1%
COMMERCIAL	3.360	29%
RESIDENTIAL	7.068	61%
AGRICULTURAL	0.811	7%
SOCIAL	0.232	2%
TOTAL	**11.587**	**100%**

Figures 6 and 7, shows the analysis and pattern of the land use. The figures and Table 3 revealed this suburb as essentially a residential area (61%), with pronounced commercial activities (29%).

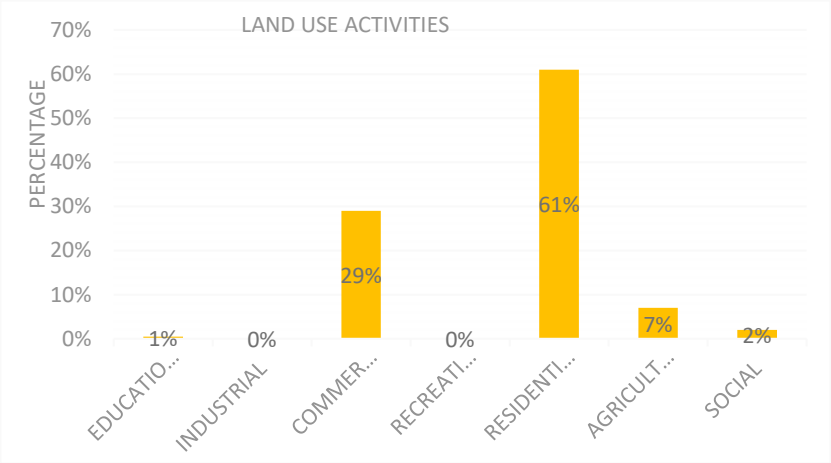

Figure 6: Land Use Analysis of the Community

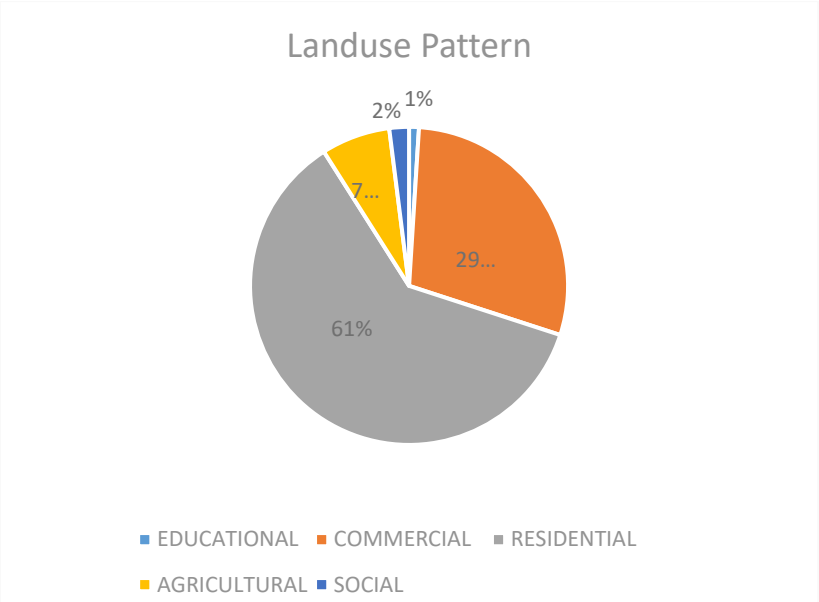

Figure 7: Landuse Pattern Chart.

3.1 Observations

Observation from the visits to the study area confirmed these commercial activities concentrates along the major access roads (Plate 1) in accordance with Hurd's star theory of urban growth that a city grows from its centre along its major transportation arteries.(Imimole 2005, Ogunlade 2018). The commercial activities in the community were observed to be trading complexes, shops and petty trading stores. No major markets was observed to be present in the community.

Plate 1: Commercial activities along the major access roads

These observation shows that the study area is a developing suburb. Urbanisation, which is a prominent factor in Akure metropolis according to Oyinloye 2010, Owoeye and Ibitoye 2016, Ogunlade and Enisan 2016, Ogunlade 2018, is also prominent in the

study area. From personal observation and interviews conducted, it was gathered that the residents in the community are elites that are either retirees of various government institutions and organisations especially of Federal University of Technology Akure (FUTA) and Ondo State, or those still in active service. The influence of FUTA is highly noticed through the presence of student hostels constituting about 60% of the buildings in the study area (Plate 2). The population and social activities are usually high when students are in session and vice versa.

Plate 2: Student hostels constitutes about 60% of the buildings

Agricultural activities as shown in Table 3 were discovered to be local fishing and petty farmlands which the residents testified to be mainly for family sustenance and not grossly commercial . There are no mechanised farming present. Fish ponds, in-house farms, gardens, indoor poultry were found spreading all over the study area (Plate 3).

Plate 3: Fish and Petty Farm lands in the study Area

Educational landuse consisted of few private schools around the area established by the residents (Plate 4). There are no government schools in this community.

Plate 4: Private Educational Institutions in the study area

Socialisation and Recreation is highly minimal in the community, as most of the residents are civil and public servants. Only very few of the residents who are students participates in few social activities during weekends, such as playing/watching soccer, partying, indoor games.

3.2 Problems in the Community

From one-on-one interviews conducted on the residents and physical observations of the study area in general, the following were discovered as serious issues that is calling for urgent attention:

There are presence of unguided and uncontrolled refuse dumping (Plate 5). This is dangerous to human health. The environment is also at the risk of hazards like flooding and erosion which invariably is a threat to the farming practices in the area and food production.

Plate 5: Unguided and uncontrolled refuse dumping in the study area

The community is full of poorly conditioned roads and insufficient drainage system Plate 6. The sloppy topography of the study area requires adequate drainage system to control erosion and preserve the roads and the buildings.

Plate 6: Poorly-conditioned roads and insufficient drainage system.

Poorly-conditioned roads and insufficient drainage system can aid loss of life and properties through all forms of accidents, flooding and erosion. Various surface runoffs and sheet erosion gradually developing into gully erosion were noticed all over the study area (Plate 7), which if not checked can result into gully erosion that will make the soil unsuitable for any kind of farming hence affecting food production.

Plate 7: Surface run off and sheet erosion

There is the absence of Street lights, which is a threat to the security of lives and properties of the community. The community is void of water supply. Individual wells and bore holes dug by residents spread all over the area. Water has always been a problem during the dry seasons.

4.0 Conclusion

The findings in this paper is a revelation to the power of the techniques of geomatics to help illuminate a community on the management of its natural and artificial resources. The pattern of the landuse of a community is a strong index to the extent and nature of utilization of its resources. Mapping is a strong tool that make proper policy decision making easier and efficient. Geomatics has been undoubtedly proven to be the bedrock of all meaningful development from the study. The study has made it easier to see where individual and government intervention is highly and urgently needed in the future development of this suburb under consideration, as it can be in other metropolitan suburbs.

5.0 Recommendations

From the the study, it is hereby recommended that the geomatics community (Surveyors, Geographers, Planners, Engineers etc) should get involved in the actualisation of future cities through regular mapping of the suburbs. Previous Geomatics activities have been concentrated mostly in the cities and at small scales. Large and small scale mapping of the suburbs of metropolis is inevitable in the pursuit of the development and realisation of future cities.

A yearly update of this work is recommended to help Apatapiti community know the spatiotemporal dynamics of its landuse for faster and efficient development; and stir up other communities in the encouragement of geomatics activities in their areas. The use of Satellite Remote Sensing techniques will provide more efficient updating of the mapping and analysis of the spatiotemporal dynamics.

The study is recommended to be adopted as sufficient for a Land Information System (LIS) applications and database creation for the community.

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