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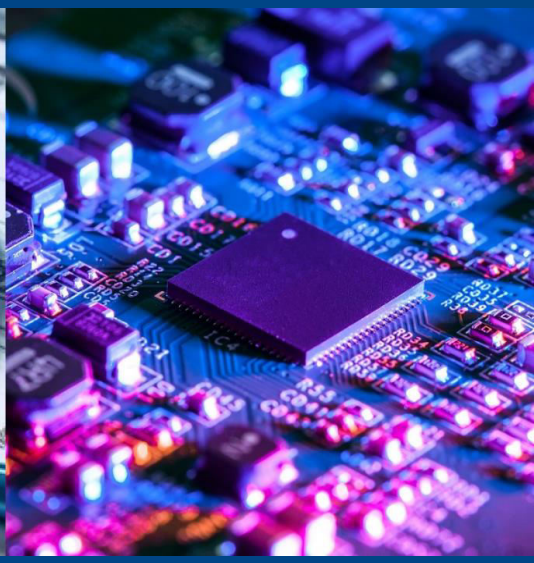

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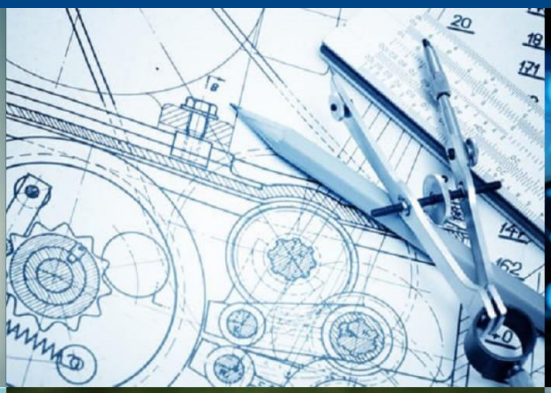

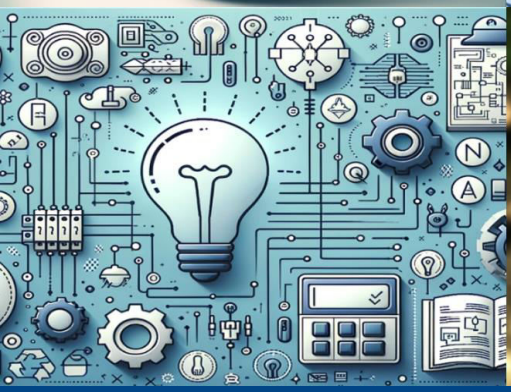

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Geospatial Assessment of Facilities on the Diobu Line Area of Port Harcourt, Rivers State, Nigeria

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ABSTRACT: The study recognized the use of Remote Sensing & GIS technique especially with High Resolution Satellite Imagery for map production, revision and updating. These techniques have at different times and stages to study the characteristics of earth features, monitor physical and natural features and also used for the development of street guide maps of different places. The aim of the study is to develop a street guide map of Diobu Line using Remote Sensing and GIS techniques. Orthophoto imagery of Port Harcourt with resolution of 0.2m was main source of data alongside with the hard copy map of Port Harcourt. The methodology adopted an integrated and conceptualized application of digital image processing and cartographic procedures. Data capture was done by field survey method using hand held GPS receiver (Garmin N72). Scanning and digitizing of data was done and ArcGIS 10.1 software and other processing software were used. Results obtained were: 13 Banks, 31 Hospitals, 18 Hotels, 29 Schools, 1 Police Station, 1 Library, 1 Jamb Office, 1 Nitel Office (non-functional), 1 Federal Road Safety corps Office, 1 Eatery (Mr. Biggs), 2 Railway lines, 1 Ministry of interior Office, 54 Churches, 2 Markets (fruit garden market) and 136 Roads. The research recommended that sign posts should be put in place to guide tourist and visitors properly for those streets that do not have names.

KEYWORDS: Street Guide Map, Remote Sensing & GIS

I. INTRODUCTION

Street guides are produced to show road information that is current especially to visitors and researchers. Maps have been used to portray information about the earth's surface, navigators, land surveyors, Town planners, military and architects. The movement of goods and services, social and economic development of the country are dependent on good road network. It is observed that there are very few rails line existing in the country and they are mostly unreliable. High and accelerating rate of urban changes and township area extensions, which leads to construction of new roads particularly in a developing country such as Nigeria, calls for an efficient and fast technique that will meet mapping standard, accuracy for mapping as well as regular updating of maps.

The processes used for mapping and revision of maps in the past have been the classical land surveying method. Nevertheless, remote sensing techniques create an insight to planning and re-planning the environment through management and decision making towards development. This scenario has given maps increase in demand due to quality maps that show position of physical features and their relativity. Aerial photographic method was also used to extract data for revising topographic maps but this proved to be time consuming and deficient especially for large coverage. The use of remote sensing data and geographic information system technique with high spatial resolution satellite imaging has great capabilities for mapping and map revision.

These techniques have been used in various, at different stages to study the characteristics of earth features, monitor natural and physical phenomena and also produce street guide maps of different places. Remote sensing is now seen as a fast means of acquiring data about the environment without physical contact with the features. The images allow a view and the analysis of different features of the environment and road network on regional and global scale. The Remote Sensing and GIS technique would be widely use for the production of street guide maps, to render solution to the issue of outdated map in the study area.

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OBJECTIVE OF THE STUDY

The objectives of the study are:

1. To identify the streets and road network in the study area
2. To analyse and produce street guide map of the study area
3. To design a database for spatial and non-spatial analysis

II. LITERATURE REVIEW

The literature review is centered on Conceptual and theoretical framework that gives an understanding of map reproduction and updating in a sequential order which is relevant to the topic under discussion.

Abbas, I. I., Adama, Y. A., & Ukoje, J. A (2010) demonstrated the production of street guide maps from remotely sensed data using GIS techniques. Quick bird imagery of 2008 with resolution of 0.6 metre was used as their major source of data while the street guide map of Kaduna metropolis produced in 1977 by analogue method of map making was also use as their base data. Ground truthing and street names were collected and placed on the map with additional information gotten from the existing street guide. The research work was based in computer interpretation of imageries using AutoCAD 2001 and srucadd.xml software. The result showed that streets in Kaduna metropolis have metamorphorsised in quantity from 104 in 1977 to 409 in 2008. They recommended the use of high-resolution imageries for digital production and updating of street guide information.

Victor, C.N., Bernard, O.E., Obinna, C.D., & Anejionu, D (2012) mapped Enugu Urban areas through the use of improved computer aided cartography (CAC). The main data used in this study were analogues street guide map of Enugu urban which was obtained from the Department of Surveying and Geo-informatics, Enugu State University of Science and Technology, and a Mikonos satellite imagery covering the study area. The methods adopted in this study involve field survey, which was carried out at the commencement of the project. Also, location such as schools, markets, hotels churches, mosques and hospitals were acquired appropriately. This was followed by the digitization of existing analogue Enugu Urban Street guide map which was subsequently georeferenced, along with Ikonos imagery, 2011 with the coordinates of the control points acquired through field survey. Features in the digitized map were vectorized into various layers of streets and topological errors were corrected. Visual enhancement was performed in the map by the selection of appropriate symbols and colours and annotations where carefully added to improve the readability of the map. The results showed an up-to-date street guide map of Enugu South Urban area produced through CAC. The map also holds a comprehensive list of the locations and names important features in the area which will serve as important data base for future related projects in the state.

Fasote, O., Kolawole, I., Adewoyin, J.E., Mohammed, S.O., Alaga, T.A., Halilu, S.A., & Muibi, K.H (2015) also produced street guide map from remotely sensed data using GIS and Remote Sensing techniques. Google earth image of 2014 with resolution of 0.6m and GPS points were the major source of data used. The methodology adopted for the research was an integration and conceptualized approach consisting of digital image processing and cartographic procedures. Data were captured by scanning and digitizing of Google earth coordinates of selected control points. The acquired data were processed using ArcGIS 10.3 software. Finally, street names were collated and placed on the map with additional information obtained from the existing street guide and served as most up-dated street guide map with further information.

Theoretical Framework

Techniques of Map Production

Basically, there are three map revision processes, they are Photogrammetric technique, Satellite techniques and Ground survey techniques.

Photogrammetric Techniques

Photogrammetry approach is the use of photography to carry out metric and analytical process of map making Photogrammetry techniques has been used coupled with remote sensing, which is the science and art of obtaining information from far without non-contact. Since it's advent as a metric tool, photogrammetry has been principally applied for topographic map production and map updating. This map revision application of photogrammetry in many countries

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has led to the establishment of fast, economic and efficient system for map revision. In Nigeria, the introduction of maps produced using photogrammetry has made it possible to cover about 95 percent of this vast country with 1:50,000 topographic map series.

Integration of Remote Sensing and GIS Techniques

Musa D, Yusuf R, K (2007) stated that remote sensing imagery has facilitated and speeds up the work of producing as well as revising maps at stages, beginning with the selection, acquisition, analysis and evaluation of the quality of base data. The potential benefits from the repetitive and continuous supply of data afforded by satellites provide the flexibility for change detection and mapping as well as revision and updating of existing maps. Remote sensing gives room for combination of data for analytical procedures as well as interpretation, manipulation, management analysis and accurate presentation of map information. This approach also gives optimal benefits as the advantages of both technologies are combined in the mapping process. This however, has been ascertained by many scholars and researchers.

Computer Aided Cartography (CAC)

Computer Aided cartography (CAC), the process of making maps by the use of computer and its associated software. It's advancement over manual or analogue method of producing maps. It allows for easy production of maps in a short time, less energy etc. This advancement made in computer technology in the twenty-first century has generally increased the speed and the capacity of various geoinformation and map-making processes. The improvements have revolutionised the map-making process, which has metamorphosed into the widely acknowledged Computer Aided cartography.

III. METHODOLOGY

The philosophy of the study involves quantitative research that is mainly attributed to field measurement and gathering of scientific data for an in-depth analysis through the following sub-headings:

Data and Source

The Port Harcourt Ortho photo Imagery with resolution of 0.2m which was gotten from the Ministry of Lands and Survey, Rivers State that served as the primary source of data. It was used alongside with spot image, 2017 with resolution of 0.5m, and Google earth map of the study area, was also used for the naming of the streets.

Materials used

The following hardware and software were used in this study.
Hardware: Hp laptop (2000 windows 8), Hand held receiver (GPS Garmin 72H), Flash drive and Mouse
Software: AGIS 10.1, Microsoft Excel and Microsoft Word.

Field Work – (Ground Survey Method)

The Handheld GPS Receiver, Germin72H was used during the field work for positional accuracy. Data capture and also for locations of public facilities such as schools, market, hotels, guest houses, churches, hospital, railroads, road/street names was done by the GPS.

Data Input and Manipulation

ArcGIS 10.1 was used for the data input and manipulation of the entity features while Microsoft excel and MS-word were used for data processing and presentation. The coordinates of the control points acquired through field Survey was inputted into the ArcGIS environment and features in the map were subsequently vectorized into layers of streets roads, utilities and services. Streets, markets, hospitals, hotels, banks, police station, schools, and churches were also enlisted.

Digitizing and Map Production

This is the process of converting a hard copy data into digital format either through scanning or other method. In the production of the map of D-line, on screen digitizing method was used. The hard copy of the old map of Port Harcourt showed D-line area, was scanned into the computer system with the Roth photo of Rivers State. Feature shape file was created to start on-screen digitizing. This involves the following step by step procedures:

1. The Arc GIS 10.1 was launched
2. The layer we want to digitize was clicked on. (I.e., layers of banks, schools, churches, hospitals, hotels, guest houses, roads, rail way, market etc.).

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3. Right click on the active layer
4. Click on Start Editing
5. Click on Ok (a dialogue box will appear on the right-hand side of the screen showing the features created)
6. Click on the feature and the construction tools below it.
7. Click on Go to X Y (in put the coordinates of Easting's and Northing's in meters of the shape file you want to digitize)
8. Click on Enter (click on add point and zoom in to see the end point of the feature)
9. Trace the feature as they appear on the imagery
10. Then click on Editor and click on stop editing to end it after you have finished digitizing.

STUDY AREA

The study spans from Mile one, Oroworukwo and Olu-Obasanjo Road. Diobu line (D-Line) is a major business and urban residential neighbourhood of Port Harcourt, Rivers State. Its geographical coordinates span from 4° 8' 08'' N to 4° 8' 22'' N and 7° 0' 10" E to 7° 0' 27" E. The Roman Catholic Diocese of Port Harcourt and the Methodist church of Nigeria have their cathedrals situated in Diobu Line, showing little variations throughout the course of the year. Average temperature is typically between 25°C to 28°C in D-line.

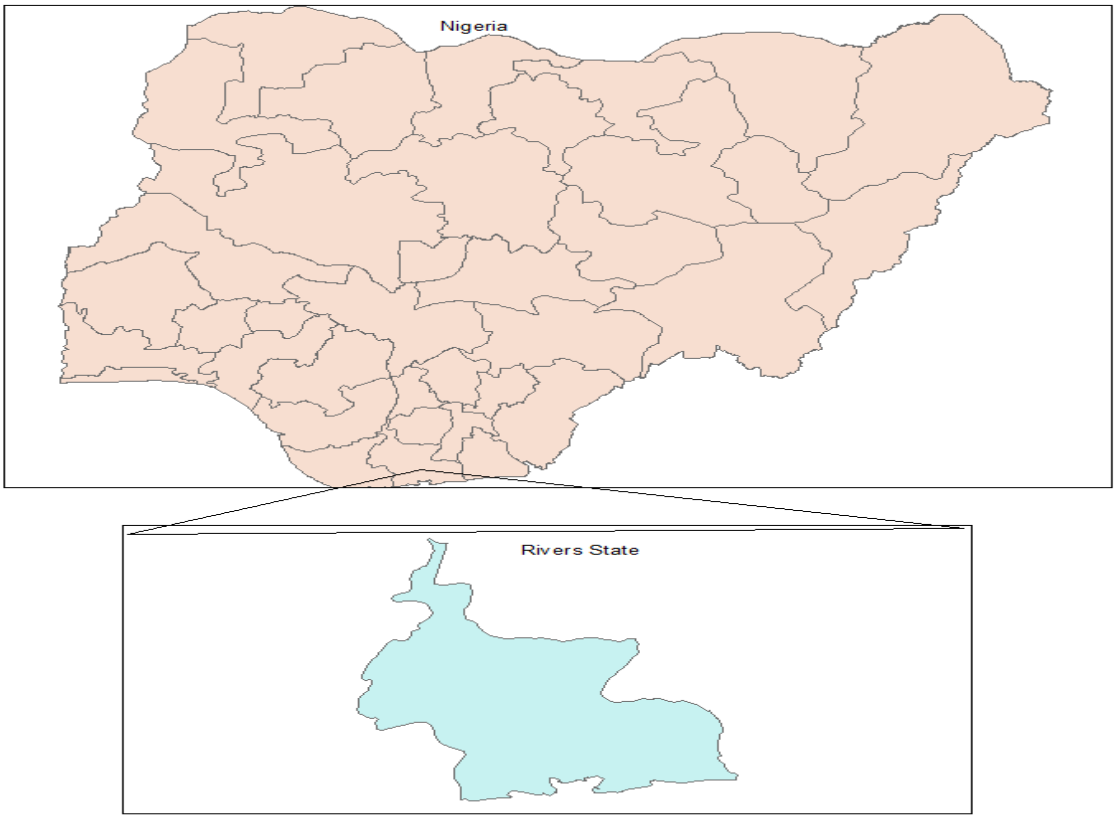

Fig. 1: Map of the Study Area

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IV. RESULTS AND DISCUSSION

4.1 Results of a Findings

The study identified a total number of 293 features which include 13 Banks, 31 Hospitals, 18 Hotels, 29 (schools), 1 Police station, 1 Library, 1 Jamb Office, 1 Nitel office (it's non-functional), 1 Federal road safety corps Office, 1 Eatery (Mr. Biggs), 2 Railway lines, 1 Ministry of Interior Office, 1 National environmental standard and regulations agency (NESREA), 54 Churches, 2 markets (fruit garden market) and 136 Road points.

4.2 Discussion of Results

The result of the study, (Table 1& 2) show a total number of thirteen (13) banks, thirty-one (31) hospitals which include: one (1) dialysis centre, two (2) eye clinic, one (1) children-hospital, five (5) specialist hospital and five (5) maternity which are functional optimally to address the need of the society within the neigbourhood. The sick could easily find hospital in case of emergency and accidental issues that may rise due to unforeseen circumstances. The banks have their functional units also, they stand to cater for monetary issues, as par withdrawal of funds from the banks and make payment where necessary towards achieving a healthy condition of life.

The area of the banks and hospital show how 'big is the bank and the hospital' to accommodate the masses during their operational hours. However, Keystone bank domicile at Aba express road could show an area of 1664.932m^2 while first city monument bank had an area of 171.299m^2 along Olu-Obasanjo. Variation of areas as documented in Table 1 is as a result of cost and space of land in the neigbourhood which differ from one landlord to another in the State.

Further findings indicated twenty-nine (29) schools, twenty-three (23) of them where privately owned and the remaining six (6) belong to government owned schools. These institutions primarily serve as a learning centres where knowledge gained is transferred to teeming youths and pupils with respect to the district of the Diobu line. More often than not, one hundred and thirty-six (136) roads which includes: two (2) major roads (Port Harcourt/ Aba express road and Olu-Obasanjo Road), fifty-seven (57) streets and five (5) foot paths. Additionally, a total number of fifty-four (54) churches were identified and the Redeemed Christian Church of God (RCCG) have the highest number, followed by Deeper Life Bible Church (DLBC) that were contained in the map (Fig. 2). With the help of the street guide, visitors, tourists, residents and other relevant agencies could have access and driving directions within D-line metropolis.

Table 1: Result of Banks in D-Line.

Bank Name	Area m^2	Location in D-line
Eco bank	1581.065	PH/ Aba express way
Keystone bank	1664.932	PH/Aba express way
First bank	1351.823	PH/Aba express way
First city monument bank	1115.48	PH/Aba express way
Skye bank	710.655	PH/Aba express way
Maxxi trust bank		Isiokpo street
Cosmopolitan microfinance bank		Igboukwu street
Diamond bank	176.639	Olu-Obasanjo road

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Firstcity monument bank	171.299	Olu-Obasanjo road
Bank of Agriculture	4695	Olu-Obasanjo road
Wema bank	569.960	Olu-Obasanjo road
Fidelity bank	193.893	Olu-Obasanjo road
Heritage bank	1006	Olu-obasanjo road

Table 2: Results of Hospital Types in D-Line.

Name of Hospital	Type	Area (M^2)	Location
Health-wise Specialist Hospital	Specialist Hospital	725.77	Benin Street
Galaxy Hospital LTD		529.01	13 Igbokwe Street
Health-rest Specialist Hospital	Specialist Hospital	321.33	Ogbia/Mbonu Street
Esteem Dental Clinic	Dental Clinic	225.23	42 Isiokpo Street
Morning Star Hospital Inc.		1242.09	21 Isiokpo Street
Pearl Clinic & Maternity	Maternity	254.43	Manila Pepple Street
Ashford & Patrice Clinic	Clinic	583.62	Manilla Pepple Street
Meridian Hospital		2773.17	24 Igbokwe Street
Bliss Children Specialist Hospital	Children Specialist	569.50	4 Okoroji Street
B-F Green Pasture Clinic & Maternity	Maternity	406.80	23 Okoroji Street
The Halten Clinic	Clinic	882.32	11 Agudama Avenue
Rambod Optometry Eye Centre	Eye Clinic	121.84	Agudama Avenue
Garrison Clinic	Clinic	532.26	9 Odum Close
St James Clinic	Clinic	292.09	13A Okorodo Street
Providence Clinic & Maternity	Maternity	515.37	11 Rail-way Close
Opus Hospital & Maternity	Maternity	225.36	Rail-way Close
Ridco Clinic	Clinic	244.54	26 Emekuku Street
Heart Health Medical Service	Medical Service	175.60	14 Omoku Street
West Hill Hospital	Hospital	150.37	4 Wogu Street
Eli Specialist Hospital	Specialist Hospital	211.96	7 Umuchem Street
Prestige Specialist Hospital	Specialist Hospital	1573.13	13 Umuchem Street
Atlantic Hospital	Hospital	1369.31	Emekuku Street
Ros Dental Clinic	Dental Clinic	336.47	45 Orominieke Street
Sinclair Medical Centre		376.99	40 Wogu Street
Holy Trinity Clinic	Clinic	229.30	4 Khana Street
Josephine's Eye Clinic	Eye Clinic	385.67	14 Khana Street
Standard Care Hospital	Hospital	387.59	Khana Street
Optometrist & Dispensing	Eye Clinic	452.08	16 Aiwa Street
Rehoboth Specialist Hospital	Specialist Hospital	523.88	3 Adam Street
Habgreen Dental Clinic & Laboratory	Dental Clinic	522.006	19 Afam Street
Emmanuel Life Dialysis Centre	Dialysis Centre	799.76	71 Isiokpo Street

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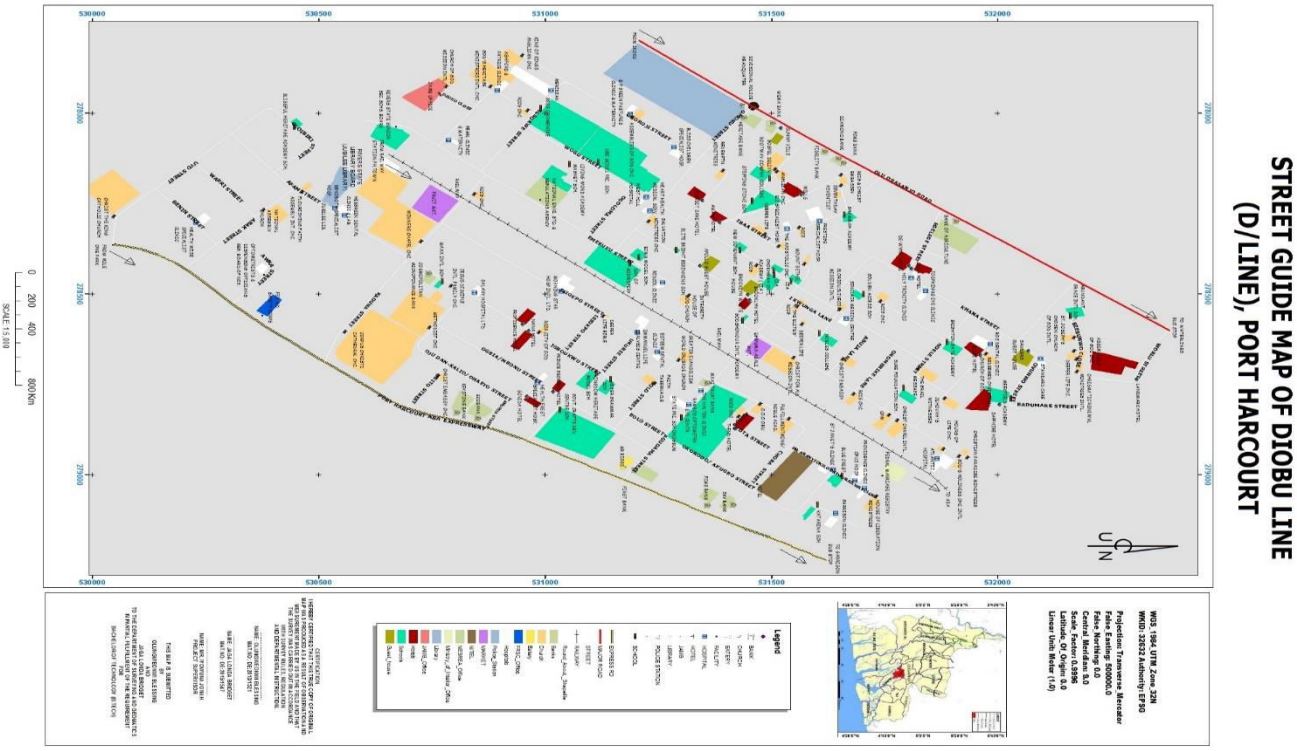

Fig. 2: Street Guide Map of Diobu Line

SUGGESTIONS

The accuracy of the produced map should be checked using an accurate quality control. Also, the full potentials of Remote Sensing and GIS techniques can be integrated into map production by:

High quality –high resolution satellite imageries should be made available at relatively low cost

- There should be sign posts to guide tourist and visitors properly for those streets that do not have names
- Relevant government agencies should endeavour to keep database of street information and names approved by them in order to arrest ambiguity in the choice of which name and road bears & the facilities located on that road/street

V. CONCLUSION

It is worthwhile to state that development of street guide map using Remote Sensing and GIS techniques is very necessary and less tasking compared to the traditional manual method of map making. The later method is very cumbersome while combination of remote sensing and GIS (RS/GIS) is cost effective and saves time. Nevertheless, RS/GIS has come to fill the missing gap in digital map reproduction.

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