Creation of Spatial Data Base Using GIS Technique of Buhari Housing Estate Damaturu Yobe State

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ABSTRACT
This paper details the development of a Land Information System (LIS)database for the Buhari Housing Estate in Damaturu, Yobe State, Nigeria. The database design was adopted from the model established by Kufuniyi. The methodology entailed a three-stage geographic information system (GIS) workflow executed within the ArcView 3.0a software environment: the creation of a spatial database, the development of an attribute database, and their integration for the on-screen digitization of the existing cadastral plan. Subsequent to database population, spatial queries were performed on the land parcel attributes, and the results were analyzed. The study strongly advocates for the adoption of such digital Cadastral Information Systems (CIS) by government agencies and provides key implementation strategies. The research concludes that a digital CIS is an indispensable tool for the efficient collation, analysis, retrieval, and monitoring of land-related data, which is fundamental for effective land administration and management both within Nigeria and globally.

Keyword: *Land Information System (LIS), Cadastral Information System (CIS), Geographic Information System (GIS), database, spatial data, attribute data, land administration, ArcView, digitization.*

1.0 INTRODUCTION

Data base is an organized, integrated collection of non-reluctant data stored so as to be able it use by relevant application with data being accessed independent; this system is designed to manage large volume of data structures stored and the provision of mechanism for the manipulation of information. Land Information System (LIS) consists of an accurate, current and reliable land record cadastral and its associated attribute and spatial data that represent the legal boundaries of land tenure and provides a vital base layer capable of integration into other geographic systems or as a standalone solution that allows data stewards to retrieve, create, update, store, view, analyze and publish land information.

A Geographic Information System (GIS) is a tool for organizing and analyzing spatially referenced data. GIS systems are based on spatial data management; each has its own unique set of requirements for data, software and distribution. GIS has enjoyed a number of years of relatively stable growth within segments like government and environmental applications. The GIS software market is now in the midst of a dramatic transition, it is moving away from being a technology that existed almost exclusively in government and utility applications. Spatial data is available in variety of coverage including streets, zip codes, address ranges, census tracts, and block groups. Spatial data is one popular form of attribute data and is readily available for various industry segments such as health care, insurance, retail and banking. As with any emerging technology in the computer industry, the recent movements in the Business Visualization and Multimedia market are now surfacing within the System Ejiobih (2011).

One of the GIS major strength is its ability to perform numerous operations one Network i.e. Network analysis which is one of the corner stones of GIS functionality application may be found in many areas such as housing co-operation and ministry of land and survey respectively. With the knowledge of GIS it is possible to design and create a data base and maintain such to ensure continuous information which could be made available in real time. Hence spatial analysis would be made to solve numerous problems leading to decision making.

Land parcel is the basic unit for access and control of land, land use decisions. Current, reliable land information necessary for publics programs, land planning, infrastructure development maintenance, environmental protection resource management, emergency services, social service, programs and so forth. LIS provides a base for land markets, development and other economic activity. LIS helps in updating of the maps, Simpson (2012).

Vital components for human life are land, access to land and managing the land. The land is fundamental for humankind because it includes all things upon it such as roads, buildings, animals, the air above, the water and the minerals within its surface. The land means to many people the space for their activities and the different forms of holding and managing its resources. In Nigeria, it constitutes a basic and critical resource at the economic, social and affective levels. Investors consider that among economic speculations the land is seen as the most profitable and secured investment Yusuf (2012).

The establishment of a cadastral system, in Nigeria, will linked is to the progress of the activities of three fundamental components, juridical cadastre, national cadastre, and national land agency.

One of the important components of any cadastral system is the cadastral maps. But the existing system in the study area consisting of paper maps and conventional land registers are becoming inefficient, for this reason a cadastral information system (CIS) based on digital cadastral map in which attributes and map data on cadastral unit stored in the same data base cannot be ignored. The role of this cadastral system is to enhance the management and control of land resources, for sustainable development. The advent of computer technology has modernized the existing cadastral system. Some governments are forced to improve on the system due to the fact that the

old system is becoming inefficient in areas such as: Slowness of updating, retrieval and storage process in the conventional system and the disability for performing analysis and report in an easy way. An information system may be formally defined as a combination of human and technical resources, together with a set of organizing procedures that produces information in support of some managerial requirements (Dale and McLaughlin (1988).

A system of records or inventory of ownership and interest in land parcels is called a cadastral or cadastral system. A land parcel refers to an area of land which may be identified as a unit for information recording such as residential plot of land. A cadastral is supposed to provide statistics of all issues relating to ownership, use and status of landed property in a given geographical area.

The principal function of a cadastral is the provision of data concerning such matters as land ownership, value and use. It may for example, provide the information component of land registration. This is the process whereby various rights in defined units of land are officially recorded. The information in a cadastral is collected, stored, referenced and retrieved primarily at the land parcel level. Other referencing systems, such as coordinates, may then be added to facilitate data manipulation and the exchange of information with other systems. The cadastral records consist of maps and text, these are linked by a unique property identifier such as the postal address, the coordinates of the parcel's centroid or a sequential number assigned on a district-by-district basis. Frequent users of the cadastral range from existing or prospective land owners to lawyers, surveyors, values, real-estate managers, and other agencies at all levels of government. The classical cadastral or method of keeping land records and land register using paper or cards has many inherent problems. It is not only inefficient but also cumbersome to operate. With the introduction of Cadastral Information System (CIS) which can simply be seen as Geographic Information System (GIS) can obviate most of the disadvantages of the classical method of keeping land records. The operation of a Land Information System (LIS) includes the acquisition and assemblage of data, their processing, storage, and maintenance; and their retrieval, analysis and dissemination. The usefulness of such a system will depend upon up-to-datedness, accuracy, completeness, and accessibility, and also upon the extent to which the system is designed for the benefit of the user rather than for the producer of the information (Dale and Mclaughlin (1988).

The objectives of this paper are to discuss the role of the three components to establish the Nigerian cadastre and present new orientations of the National Agency of Land Registry, cadastre, and Cartography. A new vision is proposed, in accordance with the new requirements, to establish a multipurpose cadastre supporting land management Ayeni (2013).

GIS application utility service management will bring about an increased ease in data communication and process. Most of the problem inherent in the analogue system will be overcome by the application of the digital technology and modern techniques which has increased the efficiency and speed in mapping of utility services. The revision of such maps which are in digital format is a painless exercise and provides up-to-date information for effective management of the utility services.
Spatial referenced data in digital form are really available for the production of maps at difference scales and formats. Digital technology therefore provides convenient and quick access to available information for planning design, costing execution of stages of projects, such as infrastructural mapping Scherer (1997).

Database can be defined as a collection of persistence data, is used by the application system for given an organization, individual or institution. A data base system is essentially a computerized record keeping system. It is an electronic method of filing cabinet, i.e. a repository for the collection of computerized data files for the Buhari housing estate, Damaturu, Yobe state.

The modern method of data storing and retrieving involves the use of electronic machine which is more faster and accurate presentation of the collecting data.

The power of database come from the body of knowledge and technology that has developed over several decades and embodies in specialize soft ware called Database management system (DBMS) or more colloquially a "database system". The created database must be well managed especially with respect to data security and data integrity. Once the database has been created, it should be properly maintained to meet its stated objectives.

1.2 Statement of the Problem

There have been long existing problems associated with the establishing multipurpose cadastral information system in Yobe State housing co-operation. In ministry of land and surveying entirely, for the purpose of this project the following attributes were collected which include: names of owners, coordinates, plot numbers, monthly tax collection.

Improper keeping land information and transaction record has been source of serious problem in dealing land issues in Yobe state. Many people have been victims of fraudulent activities of land speculative who convince with land documents such as problems duplication of land record, duplication names, overlapping. And update. Maps and record will make it easier to achieve the goal of management of structures, so far, based on record available, there is no really created attribute data of the housing estate and even the available are only analogue and can fit in to the present status of the present age so many developmental changes that have been taking place.

More importantly there is no database for some important features in there; as a result, ministry of housing could not be able to view areas of needs maintenance of ministry will embark open without going to the side before decision could be taken. The revision of such maps which not in digital format is a painless exercise and does not provide information for effective management, spatial reference data in digital form makes production of maps at different scale and format easier and faster. Digital technologies provide convenient, quick, adequate access to available information for planning, design, costing and execute of stage in projects, such as in fractures installation

1.3 Aim and Objectives of the Study

The aim of this project is the creation of database for Buhari housing estate, Damaturu, Yobe State. The aim would be achieved through the following objectives.

1. To update the existing analogue map of the study area and create database of the study area.
2. To generate queries and observed the cadastral information system responds and produce compose map of the areas.

1.4 Motivation of the Study

With the increasing demand for plots, building within the estate and its surrounding, there is need for the creation of spatial and attribute database to manage properties and the housing estate for easier finding of attribute of land were information that may be required. This could be graphical or computer (digital) based. It is recognized that there is a need to have the positional information of all element of spatial database as to useful easy operation and decision making.

1.5 Scope of the Study

The research is limited to the creation of spatial and attribute database for the Buhari housing estate, Damaturu, using geographical information system. The research consists of 140 parcels of land and covered total area of 87 hectares

1.6 Study Area

1.6.1 Relief

The relief of Damaturu, LGA consists of undulating plain interspersed with Sahara ranges between Gujba to Maiduguri the east and to the north, stretching to Tarmuwa The Sahara ranges run from Fune area through the border between and LGAs. From any vantage point in Damaturu

town, one can have a glimpse of these beautiful ranges looming in the background.

1.6.2 Climate

Damaturu LGA has tropical continental type of climate characterized by well-marked wet and dry season. The wet season usually begins around April and ends in October. The dry season begins in November and ends in March. The dry season is characterized by the prevalence of the northeast trade winds popularly known as the harmattan wind which is usually dry and dusty. Damaturu has a mean rainfall of about 1,1350mm and annual mean temperature of about 39ºC. Relative humidity ranges between 50 – 65 percent during the wet season to about 30 – 40 per cent in the dry season (Global Land Cover Facility)

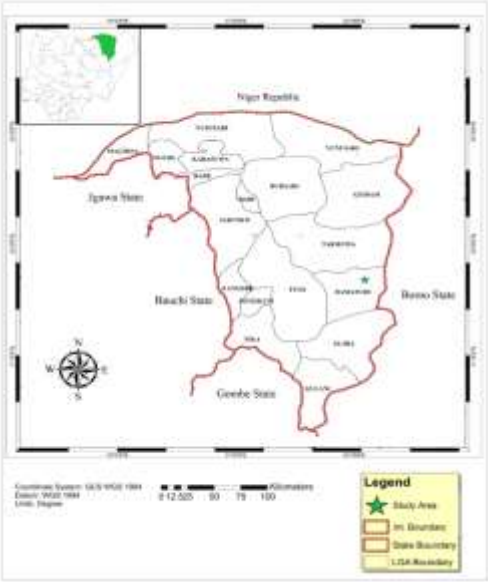

Figure1 Map of YOBE State showed Damaturu

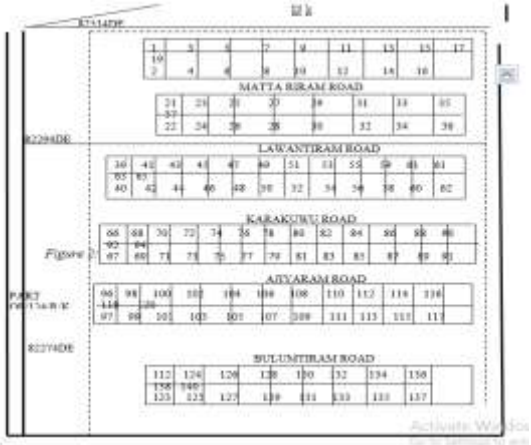

Figure 2 layout plan Buhari Housing Estate

From ministry of housing estate, Damaturu, Yobe State were collected the items as follows;

a. Residential layout plan for Buhari Housing estate.
b. UTM Township map sheet.
c. Cadastral survey plan showing plan showing the housing estate.
d. List of allottees from the main allocation register.
e. Political map of Yobe State and Nigeria.

2.0 Hardware

The following hardware used:

1. HP Laptop.
2. Printer.
3. GPS.
4. Scanner.

2.1 Software

1. ILWIS.
2. Arc view 3.2 [GIS] software.

2.2 Data Processing

Data processing involved computer application of appropriate hard ware. soft ware and the procedure on the collected analogue data thereby transforming *through* scanning digitizing and direct keyboard alphanumeric data input. The data processing resulted to the creation of both spatial and attribute database.

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3.0 Type of Data

After the office and field reconnaissance both primary and secondary data were obtained from the field and other source respectively.

3.1 Source of Data

The primary data for the study was obtained from the field observation while the secondary data was from ministry of housing estate, Damaturu, Yobe state.

3.2 Acquisition of Data

Acquisition of data involved gathering of relevant analogue cadastral record from the data source. This is computer based project

which involves scanning , digitizing as well as establishing linkages between graphic data and its corresponding attribute based on the collected primary and secondary data.

3.3Geo-referencing

This is the process of establishing the relations between row and column number and real world coordinates. Geo referencing of the layout design plan would be done through the following steps.

3.4 UTM Conversion

Data convention was be done through the following steps Select ellipsoid dialogue box appear, click Clark 1880 then ok click datum, select Datum dialogue box appear select minna, under area select Nigeria then Ok, then type of the zone (32) the ok, ok again.

Geo-reference editor dialogue box appears showing the imported map using the cross click point 1,2,3 and 4 start with point one by clicking the edge point 1 add tie point dialogue box appear then enter X and Y coordinate i.e. easting first then Northern second.

Point 1E=822439.90
N=1301929.90
Point 2E=823221.51
N=1301929.90
Point 3 E=823221.51
N=1302276.41
Point 4 E=823039.90
N=1301929.90

The explanation point 4 and click the point there x and coordinate the appear if is correct with the coordinate of the point it then ok, check the AFFINE, sigma, the accuracy value which is 0.3 was computed.

3.5 Digitizing

This is the process of converting the spatial feature on an analogue map plan into digital format.

1. Manual digitizing.
2. Scanning.
3. Coordinate geometry.
4. Key entry.
5. Translation of existing file.

3.6 Segment Map Digitization

In ILWIS software, there are basically three types of maps, these are point map point. This section therefore, explains how line segment was be digitizing. A segment has series of intermediate points linked sky arcs having begun and end nodes, the intervening vertices help to define the true shape of linear feature connected segment created an area object. Line segment are connected together at nodes through the process of snapping. Snapping is needed for polygons and for segment map that represent a network. Example road network, Segment was digitized in stream mode i.e. By holding down the digitizers' button and simultaneously moving the cursor on the line or by digitizing in point node i.e. processing the cursor button only when a point in the segment need.

3.7 Operation

After referencing the plan to be digitized as previously explained

- The segment editor window opens and adds segment command box opened.
- To digitized a feature on a layout plan.
- Positions the digitized map from the analogue plan but under different layer segment.

3.8 Editing

The final stage of segment digitized was checked and edited segment.

Intersection of Line without Node. This is the situation where the segment overlays another segment without a node. Dead end in Segment This is the correction applied to make sure that the segment is not connected to another segment. Self-Overlap this is the situation where a segment crosses itself.

3.9 Topology Creation

This is the technique used to record and manipulated the logical relationship of features on a plan and their geo-graphical information. In this project, the topology was created through polygon sing the segment.

3.10 Database Creation

The creation of a database similar to its design is subject to the type and nature and the amount of the information to be stored.
The information to create database for in this project is that which give detail about series of structures and the (information) contained short phrases and numerals, which can be contained in a tabular form.

3.11 Creating Table

Tables can be obtained into two ways either by created them in ILWISS and entered the values manually through the key board or by importing existed data in other file format e.g. from access or database.

Table creation in this project would be made in ILWIS and Data entry done manually used keyboard.

i. Double clicks the "New table" item in the operation's list a created table dialogue box emerged
ii. Type the name of table in the textbook "Table name and description"
iii. Select the domain from the list box domain
iv. Click ok
v. Now table window opened
vi. Type the titles of the various column of the table using key board.
vii. Input information in the appropriate column against each building highlighted.

3.12Table Editing

The database table was edited and necessary correction mode through the highlighting of each building and displaying its information for checking.

3.13Data Management

The management of graphic and non-graphic database has distinct characteristics and thus different options techniques for the management one notable characteristic of graphic data is their high volume, which requires efficient findings and retrieval procedures. Non-graphic data generally are processed using standard alphanumeric data management software and structure.

These GIS system vendors used varying design approaches to the diverse requirement for handling graphic and non-graphic data. Some systems separate graphic and non-graphic data and manage each type with software and management structures. Such software which uses or handles both types is ILWIS which will have been use in this work because it is a geographic information system (GIS) software capable of handling both graphic and non graphic and non graphic data, management and possibilities of querying graphics using attribute. dpi resolution or more are preferable). Draw figures clearly and embed text in the image properly. Do not cut and paste from another text and ensure that after printing, the images look good and readable. Do not use outer boundary.

4.0 RESULTS AND DISCUSSION

This chapter is a journey in GIS which take us from raw data captured from field to presentation of the various categories of digital topographic map of the estate. Digitized analogue survey plan of the Buhari estate, Damaturu, Yobe State has been successfully achieved which made the plan to be converted into a digital format. It is now updated, more presentable and looks more impressive. Each of the layers can now be used for specific users need because a particular feature layer can be queried and be used for a purpose depending on the users demand. Such as building project, proposal and other research activities Of course, updating the survey plan was one of the tasks carried out where some features which were not in existence at the time of compiling the analogue plan are now inserted which made the plan to be an up-to-date. Though, some information on the analogue plan have been ignored due-to their irrelevance to the project scope e.g. NEPA power installation as the project is mainly concerned with the academic facilities within the study area:-

Each of these layers where highlighted, can retrieve separately. The combine segment can be seen in fig. 1 in hard copy.

4.1 Query Generation

This project was able to link the graphic information and their attribute information in the same software; as a result different forms of queries were possible.

This are query by occupation is shown in hard copy in figures below also an example of query attribute by owners address is shown.

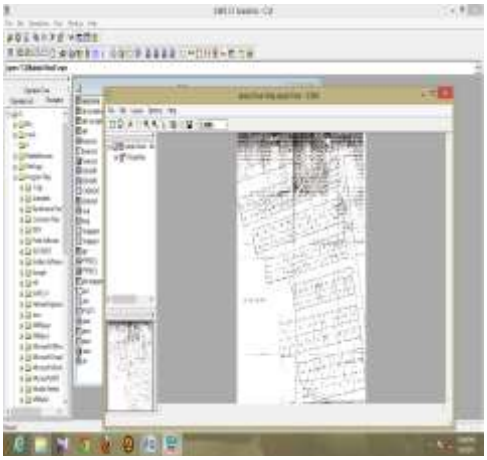

Figure4.1 Geo-referencing

The process of the Geo- referencing the base map by computing the coordinate of easting and northing of each four point, This is the process of establishing the relations between row and column number and real world coordinates.

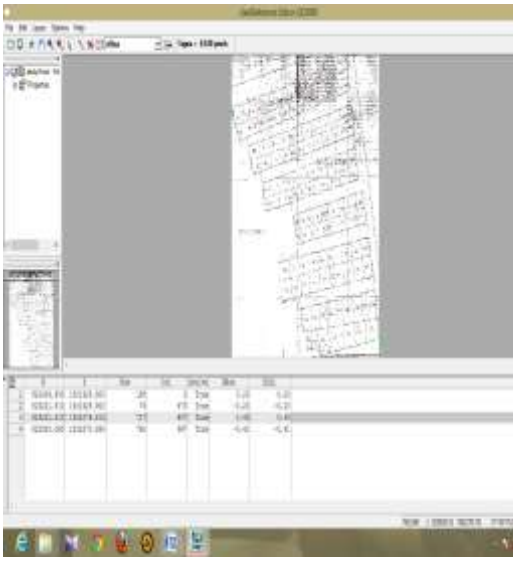

Figure 4.2: geo-referenced base map of the study area

4.4.2 Digitization

This is the process of converting the spatial feature on an analog map or plan into digital format.

Depending on the methods adopted and availabilities of the necessary material to be used in analog map conversion, there are various technique used in digitizing an analog map or plan which include;

- manual
- scanning
- coordinate geometry
- key entry
- Translation of existing file

Digitized plan of the study area Individual organisations comprising the land information system have embraced new technology by introducing digital systems to replace or complement existing internal analogue processes. These well documented, individual, technological advances represent both considerable investments and savings, but other organisations in the cadastral system cannot necessarily fully access the digital data or its associated benefit

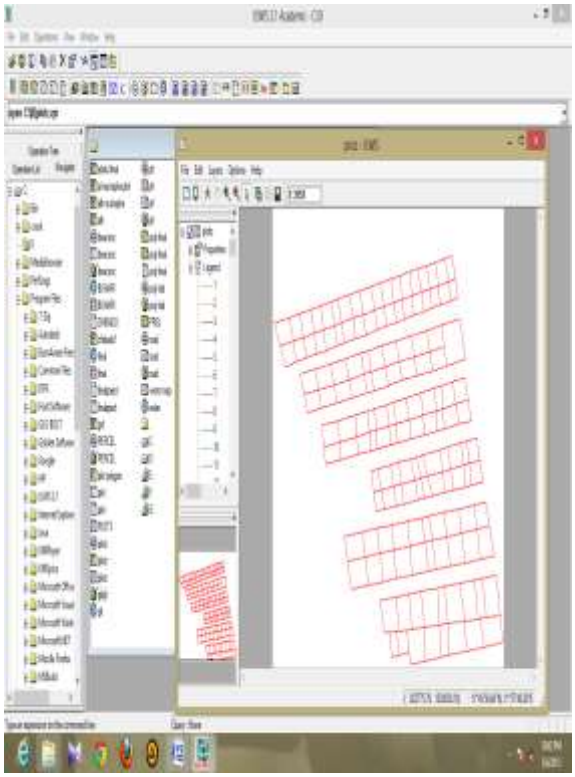

Figure 4.3: Digitized plan of the area

4.4. Query on landed parcels

This query on landed parcels of plots,. The distribution of the spatial cadastral information must take account of the importance of the currency of the cadastral map that provides the infrastructure component for many Geographic Information Systems (GIS) applications. It is important for utility and local government information systems because most of their business information and transactions are related to the land parcel. Cadastral maps are used as a base for delineating utility infrastructure (water, sewer, power, gas and communications) as well as planning and zoning activities, emergency response, tracking crime, etc. The updated cadastral map, and its impending changes, need be made available to all users, in a timely and efficient distribution process.

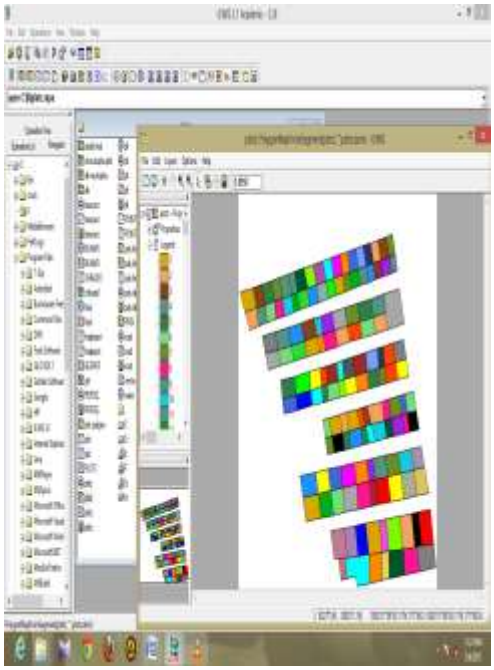

Figure 6: Query on landed parce

4.4.4 Query on Attribute

This can be query generation by the attrite database to link with the spatial. The creation of a database similar to its design is subject to the type and nature and the amount of the information to be stored in the database. The information to create database for in this project is that which give detail about series of structures and the (information) contained short phrases and numerals, tabular form.

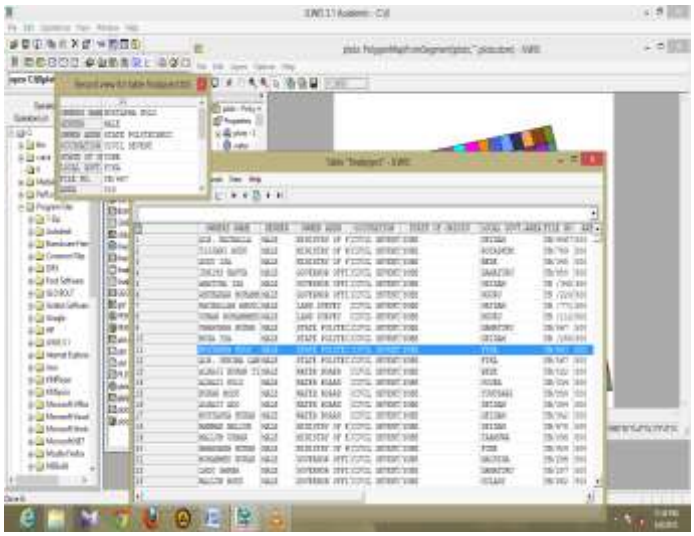

Figure 7: Query on attribute

4.4.5 Query on staff category

Query by staff this project was able to link the graphic information and their attribute information in the same software; as a result different forms of queries were possible. This are query by occupation is shown in hard copy in figures below also an example of query attribute by owners address is shown.

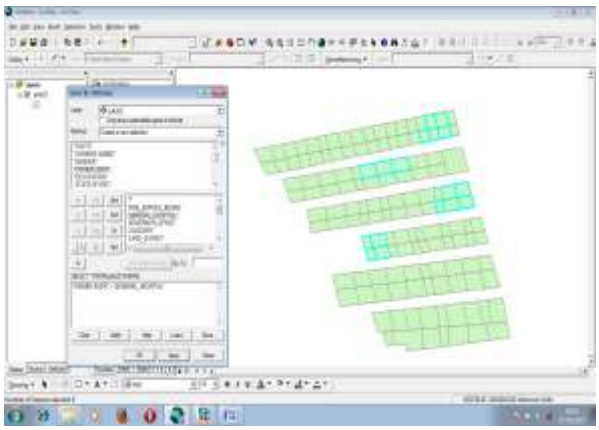

Figure 8: Query on staff category

5.0 Conclusion

In the foregoing section, the development and element of a creation of database have been described. Creation of Database have been showing to be an essential component of the fundamental datasets of a geospatial data infrastructure as it has multiple application areas.

This project also discussed how Creation in a parcel of land, has developed into a multipurpose creation. This development is absolutely more beneficial to the society. Such arrangement however would result to overcrowding of a map with information. Computer technology makes it possible for the content of such a map to be separated into layers, based on as many themes as are desired, and to reassemble any group of these according to the required purpose. The technology will also allow these map layers to be updated easily or revised in order to maintain currency of the information therein. By establishing a good network with proper authorization, creation plans and the printing of it will be accessible from any of the stations. The system will provide creation services much more quickly and at a much lesser cost. The problem of storage will be a thing of the past as all records can be saved into a few magnetic disks and kept away as back-up copies. It has been found that the GIS method of storage, retrieval of information in terms of speed, data analysis, integration and manipulation of data, as well as the graphic representation of features in forms of maps is better than the conventional creation system. It is possible to design, create and use database for effective monitoring and protection of the environment and control of resources by exploring GIS capabilities in linking both the spatial and non-spatial data in real time which helps in data analysis and decision making.
Furthermore, the GIS software that was used in this project is the Arc-view version 3.0. it is interesting to note that what distinguishes one database from the other is simply the attributes of the applications e.g. attributes for utility varies from that of forestry, but the two can be in the same location i.e. they are located by of forestry, but the two can be in the same location i.e. they are located by x, y and *z* coordinates.

5.1 Recommendations

From the foregoing discussion, it is here by recommended that;
Creation of Database for Buhari Housing estate in the state for quick access to information in respect Housing accommodation, updating maintainers and proper allocation to civil servant.

- The government should be in regular consultation through seminars, workshop with the stakeholders in housing so as to implement policies and programs needed for effective management of housing estate.
- Government should as matter of urgency embark on an aggressive manpower training and development in modern skills and methods.
- Ministries should as a matter of urgency and need acquire modern 0instruments for Geo- data acquisition and processing.

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