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Improving Property Management Using Geographic Information System (GIS). A Case Study of Udoka Housing Estate, Awka, Anambra State, Nigeria

Igwe Chinelo[1*] Oladejo Esther[1] Obodoh Chikasi[2]
1.Department of Estate Management, Nnamdi Azikiwe University,P.M.B. 5025, Awka, Nigeria
2.Department of Estate Management, Enugu State University of Science and Technology, Nigeria

Abstract
The creation and updating of spatial and non-spatial information on estates is a herculean task. The volume of data that necessitates proper keeping is quite cumbersome and cannot be effectively handled by traditional method or system of record keeping. In Nigeria today, the method being adopted by Estate Surveyors in management of properties is the traditional or analogue system, which presents an inflexible form and format, leaving no easy room for updating. The aim of this study was to highlight the power of Geographic Information System in automating the management of housing estate with a view to proffering solution to the problems that are inherent with traditional or analogue method. In conducting the research, primary and secondary data were obtained. Questionnaire, interview and observation (Geographic positioning system perceiver) were used to collect primary data while secondary data were obtained from maps, journal, books and internet. The map was digitized and imported into the Arc View 3.2a. Attribute tables and queries were also created. A digital map and a database of Udoka Housing Estate were created in Arc View software environment. The developed GIS can be used to provide answers to different types of queries such as; Name of owner, address of property, state of repair, use of which property is put etc. The researcher thus recommends that the old system of storing spatial and non-spatial data in cabinet be replaced with computers and GIS as it will provide improved data.
Keywords: Database, Geographic Information System (GIS), Structured Query language (SQL).

1. Introduction

Housing is one of the basic necessities of man which is usually provided by private or public enterprise. State Governments have tried to provide for its citizens by building housing estates. The general management of these estates is an enormous task. Any organization that expects to run an efficient day to day operation, manage and develop its services effectively must know what asset it has, where they are, their conditions, how they are performing and how much it cost to provide the services (Pickering, Park and Bannister,1993).

The Anambra State Housing Development Corporation (ASHDC) which manages the public estates built by state government (including Udoka Housing Estate) adopts the traditional or analogue system in handling the records or data (spatial or non-spatial) that are used for administrative work. The Estate maps are used alongside book-keeping for storing information on spatial and non-spatial data. This storage device which is analogue in nature provides an inflexible data that are stored in fixed forms which cannot be easily retrieved or updated. There is also difficulty in entering and integrating multi-source data. Inconsistency in updating or revision is quite common and it is usually a painful exercise (because of repetition of works done in the past). The analogue system does not create room for quick information and reproduction / updating of such maps is expensive and time consuming, resulting in non-current maps. Thus a 'spatial data management' problem can be seen to exist in the Corporation.

Geoinformatics technology is a management support tool that enhances geographical analysis and effective spatial data management. It has become open to value added applications in many other disciplines using spatially referenced data (Konecny, 2002). Kufoniyi (1998) described geoinformatics as a body of knowledge that deals with the acquisition, processing and management of geoinformation. He defined GIS as a computerized tool for capturing, storing, checking, integrating, manipulating, analyzing and displaying of data which are spatially referenced towards an effective decision making. It integrates spatial and non-spatial information within a single system by putting spatial information into digital forms, thus allowing manipulation and display of geographical data in an objective way. Its Implementation involves linking of both the attribute and spatial data together and generating queries that can solve spatial problems (Olaniyi, Udoh, Oyedare and Adegoke (2006).

GIS technology integrates common database (spatial and non-spatial) operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps (Environmental Systems Research Institute (ESRI), 1994). Worboys (1995), defined database as "a unified computer based collection of data showed by authorized users with the capability for controlled definition to access, retrieval, manipulation and presentation of data within it".

GIS permits geographically referenced information to be stored, edited, manipulated and analyzed to generate interpretative maps relevant for decision making. With this technology, a range of possible scenario can be explored in the management of spatial data within an estate. The primary objective of the study is to demonstrate the effectiveness of GIS as a functional decision support system in the management of real estate.

2. Study Area

Awka is the capital of Anambra State whose region covers six Local Governments which include Awka Capital Territory, Awka South Local Government area, accounting for more than half of the land area. Others are Awka North, Njikoka, Anaocha, Dunukofia and Orumba North Local Government Areas. It lies within the tropical wet climate zone with clear- cut wet and dry seasons. Udoka Housing Estate, Awka is located along Onitsha/Enugu Express Road (opposite NNPC Mega Station) Awka, Awka South Local Government Area, Anambra State, Nigeria. The site lies approximately within latitudes 60 12' 19" N and 60 12' 39" N, and longitudes 70 03' 26" E and 70 03' 51" E. It is one of the medium density estates in Awka that is developed and managed by Anambra State Housing Development Corporation, Awka.

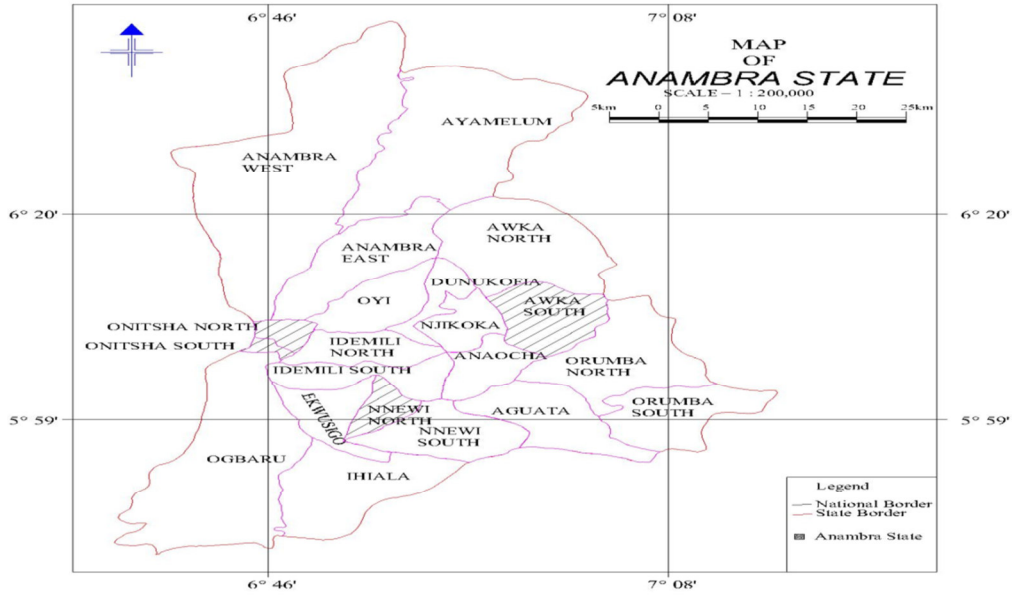

Fig 1: Map of Anambra State showing the study area

Source: Department of Surveying and Geoinformatics, Nnamdi Azikiwe University, Awka.

The areas not built upon has been due to certain natural barriers for development such as water/flood courses, erosion sites, ravines, deep valleys, shrines, religious forests and traditional sites. Urban forms of Awka exhibits a new town grafted onto the old city separated by express way and the urban elements inherent in traditional Igbo settlements, with a palace and market square at the center, providing enough space for recreation, economic and other like activities.

Land use is distributed over residential, agricultural, commercial, industrial and administrative.

With the influx of people to Awka after it was made a capital city, there was an appreciable increase in the demand for accommodation especially for medium and high-income groups. Anambra State Housing Development Corporation in response to the challenges posed by housing demand has put up estates like Udoka Housing Estate, Ngozika Housing Estate, Ahocol Estates etc. The study area, Udoka Housing Estate, is bounded by the Onitsha – Enugu expressway on the East. Presently over five hundred housing units of different residential houses exists in it. The Estate has some services like roads, electricity and a few blocks of shops. Facilities like church, hospitals, shopping complex, schools, petrol filling stations that would have eased movement out of the estate for inhabitants do not exist.

3. Methodology

Udoka Housing Estate is divided into two phases; Phase 1 and 2. A total of three hundred and fifty (350) residential houses are contained within the estate. Phase 1 was chosen for the study because most of the plots (130 out of 150) have been built up, unlike phase two, where a reasonable number of the plots are not completed. The sample size was chosen using the systematic random sampling technique. It is a statistical method involving the selection of elements from an ordered sampling frame.

3.1 Data Acquisition and Storage

The non-spatial data were obtained from the residents of Udoka Housing Estate and staff of Estate department of the Anambra State Housing Development Corporation. They included names of owners, address of properties, schedule allocation of houses, house types, accommodation types, etc. Spatial data were obtained using these specifications of the hardware system; 504 MB of RAM, Digital camera, Hewlett Packard scan jet 6100c,14" monitor CPU, Hewlett Packard laser printer 1100c, Hewlett Packard AO plotter sewers 540, Rewriteable CD, Uninterrupted Power Supply (UPS), Scanner.

The software that were used are Arc View GIS or ARC GIS 3.1, Microsoft word and Microsoft excel. The ARC View GIS allows for integration of CAD (e.g Auto CAD software) to enhance a variety of drawing of various file formation into the map without first converting these files.

Microsoft word was used in processing, editing and representation of the textual information while the data were keyed in using Microsoft excel. These were saved in database (iv) formation and finally exported to ARC GIS 3.1 for necessary implementation and queries.

As the spatial data is already available secondary data acquisition method is used to secure the data in a digital format. This method involves digitizing (manual or head up). By digitizing, spatial data features on a map are converted to digital format, this means that points, lines and are

4. DATA ANALYSIS

The data obtained were analyzed using, Tables, Fields and Forms**.** The database is a table which looks like a spreadsheet and are made up of fields and records. In Microsoft Access, a typical data table is shown below.

Table 1: Typical Microsoft Access Data Table

S/N	Location of property	Name of owner	Address of property	Repair condition	Remarks
1	Udoka Housing Estate	Mr L.K Obiorah	House 8, road 7	Good	

Each type of detail about the owner of a property is kept in its own column, referred to as a **field**. Thus, all location of properties in the table is known as **LOCATION OF PROPERTY FIELD**.

A special on-screen form where the data is to be entered is created. A form is like fill in the blank sheets in which we enter all the data. Access links the form to the table and stores all the information we put into the form in the table.

4.1 Linking mechanism using Structured Query Language (SQL)

SQL is the interface fourth generation language that GIS end users use to link different data sets of information in the GIS overlay to perform various analyses. The linkage ensures that all databases respond to queries within the GIS system and produces report in a straight manner.

SQL has two components, a spatial component (which allows a user to qualify the features to be searched according to location, house type etc.) and an attribute component, which defines the criteria to be used in selecting data. To introduce geoinformatics in the management of Udoka Housing Estate, several things were done. A 0.6m quick bird resolution satellite image (map) of Udoka Housing Estate was digitized by converting the spatial data features on the map. As a result, large volumes of data were easily and quickly assessed. The map provided the ability of merging one data set with the other. Queries were confined to point, line, polygon, buffer or any combination these components. The maps feature information was interactively queried by locating the item on the display and listing the information held in the database. For example, data on roads, house types, land use, etc. were merged together. Through the digital map, linkages were provided between the spatial and non- spatial information. With just a click on a parcel of land of interest, attributes of the parcel in question are displayed.

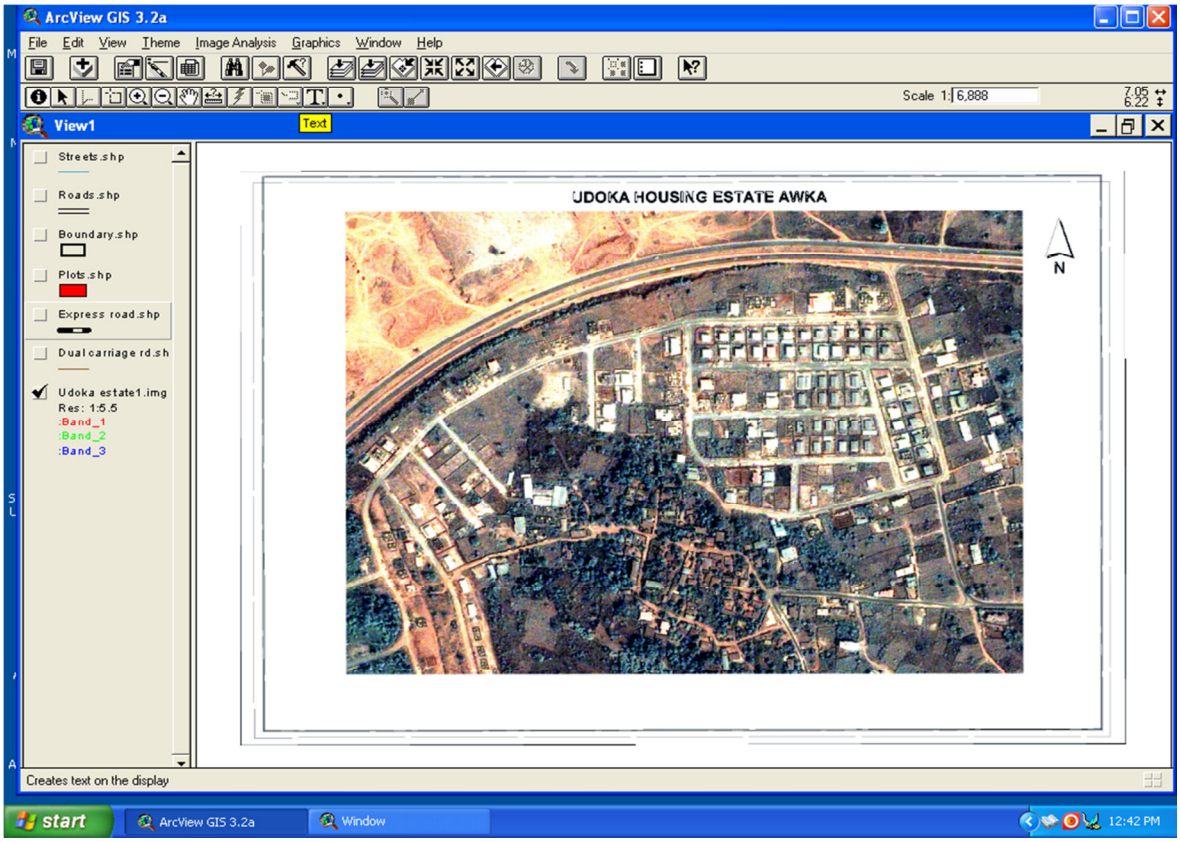

Fig 2: A GIS map of the study area (Source; Globe Systems Archive,2006)

The structured query language (SQL), in the ArcView environment was useful in the database for prompt actions/quick access to information being sought. Information like housing types in the Estate (structured deck, bungalow, site and service), owners of properties, properties state and repair condition etc. were made to be just a click away.

6.0 RESULTS AND DISCUSSION

The data collected were linked to the map and required features were shown on the map. Such features like property view and boundary shape view. This is clearly shown in Fig.3

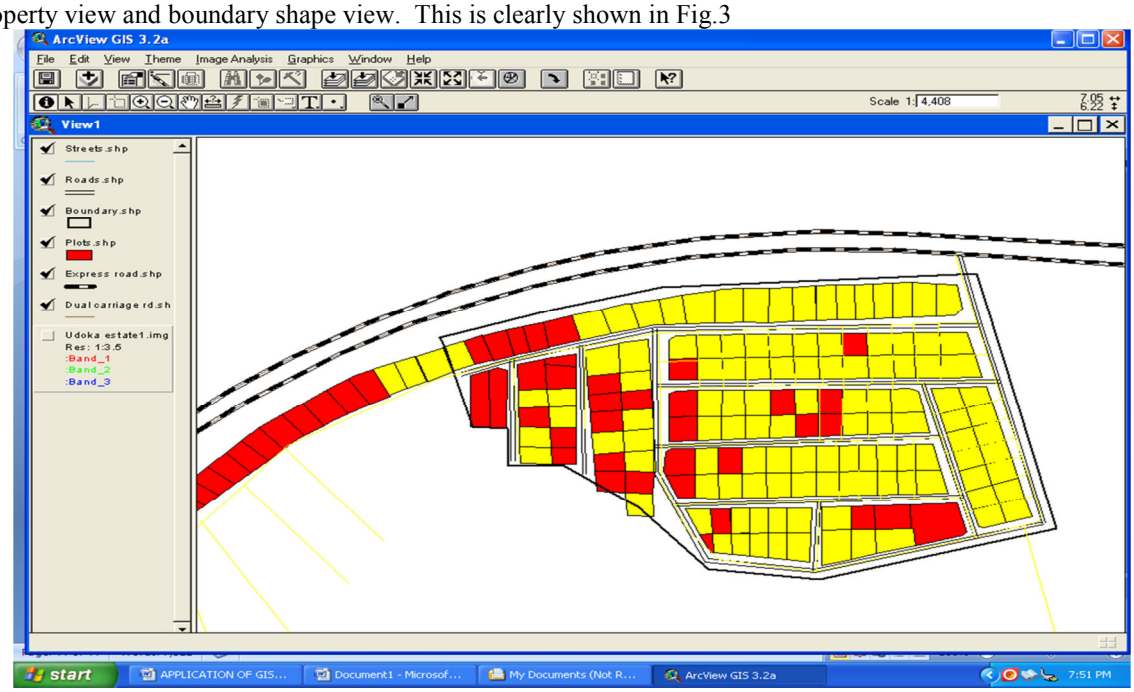

Fig 3: The GIS property view of the study area

Using the digitized map of Udoka Housing Estate, large volumes of data were assessed quickly and easily.

Through the digital map, linkages have been provided between the spatial and non- spatial information. Just a click on a parcel of land of interest will display all the attributes of the parcel in question. This is shown in Fig. 4.

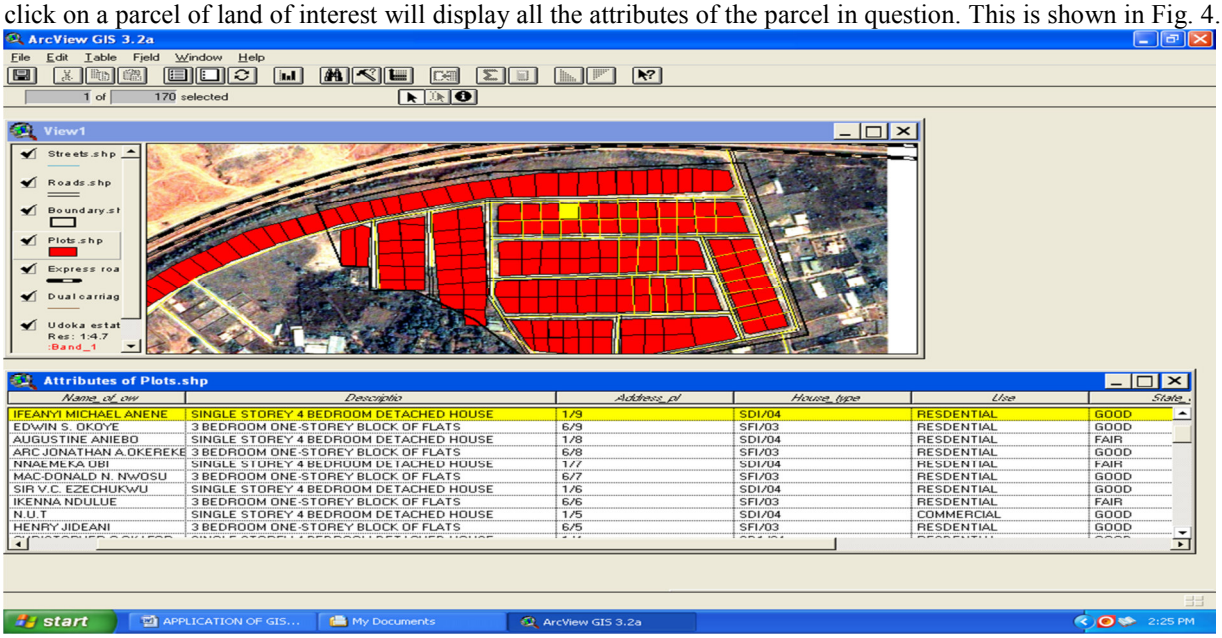

Fig 4: Attribute table of Plots in the study area

To put the system to test, some useful queries on typical user needs as they relate to housing estate management were created. All queries were tested and checked against the backdrop of expected results and were found to be satisfactory. The queries provided solutions to question/s like;

- Which of the houses is used for a given purpose?
- Which plots are developed/ undeveloped? -
- Where is property z?
- What is the accommodation type?
- What is the state of repair of the accommodations?

Fig 5 shows an attribute table, a query environment and the GIS map. A click on the query builder brought out the query environment from which the use to which properties are put was queried. Once the 'use' field and value are clicked the result showed in the attribute table and the ArcView map. The yellow colored polygons on the ArcView map show the properties that are for residential use.

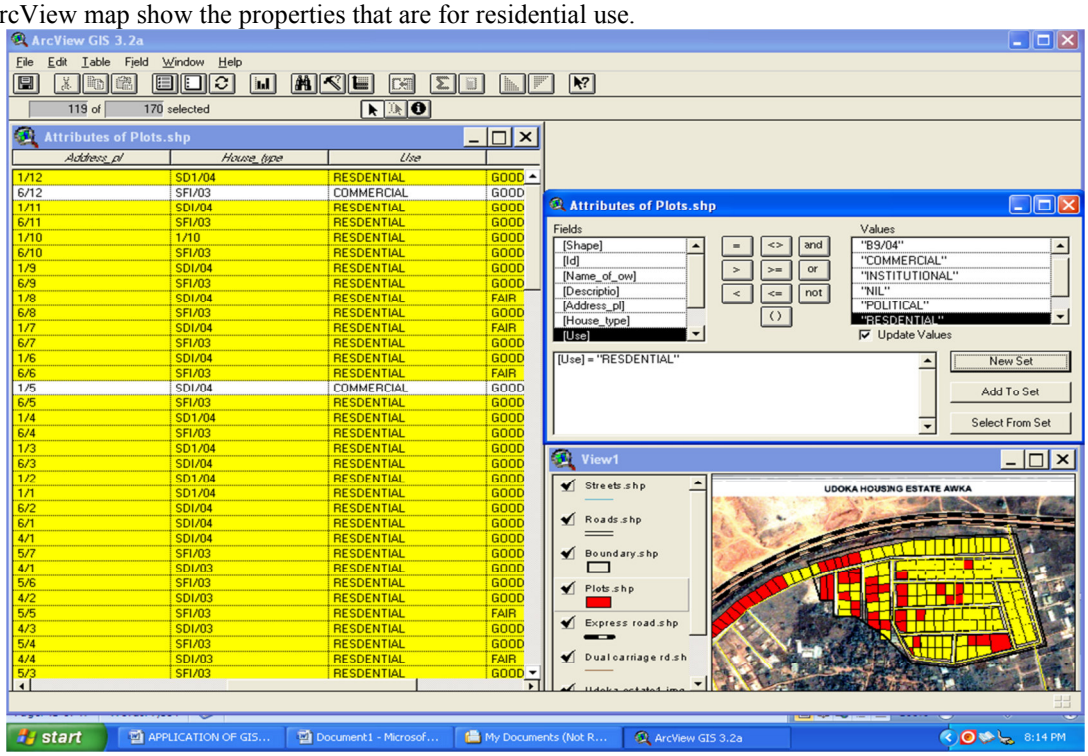

Fig 5: Query showing properties used for residential purpose

Fig 6 shows query done to know who owns which property. This query helps in identifying allottees of houses (or plots) for proper monitoring. This can help in checking double allocation in a situation where the management is still in the stage of allocation.

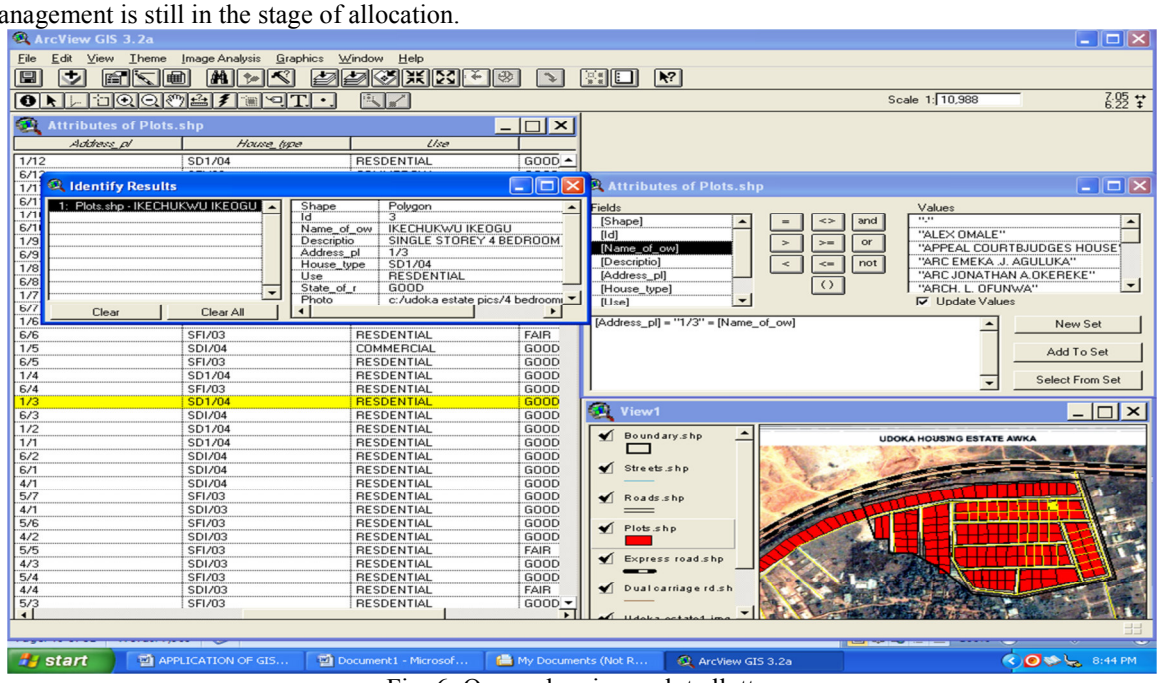

Fig. 6: Query showing a plot allottee

Taking the query, a step further in fig 7, especially when the estate is already built up, the image of a specific property is brought into the query. With the use of hot link, (which is a tool in ArcView GIS 3.2a), the image of the property is seen on the screen clearly. The management will not need to visit the site to know the property that is being referred to.

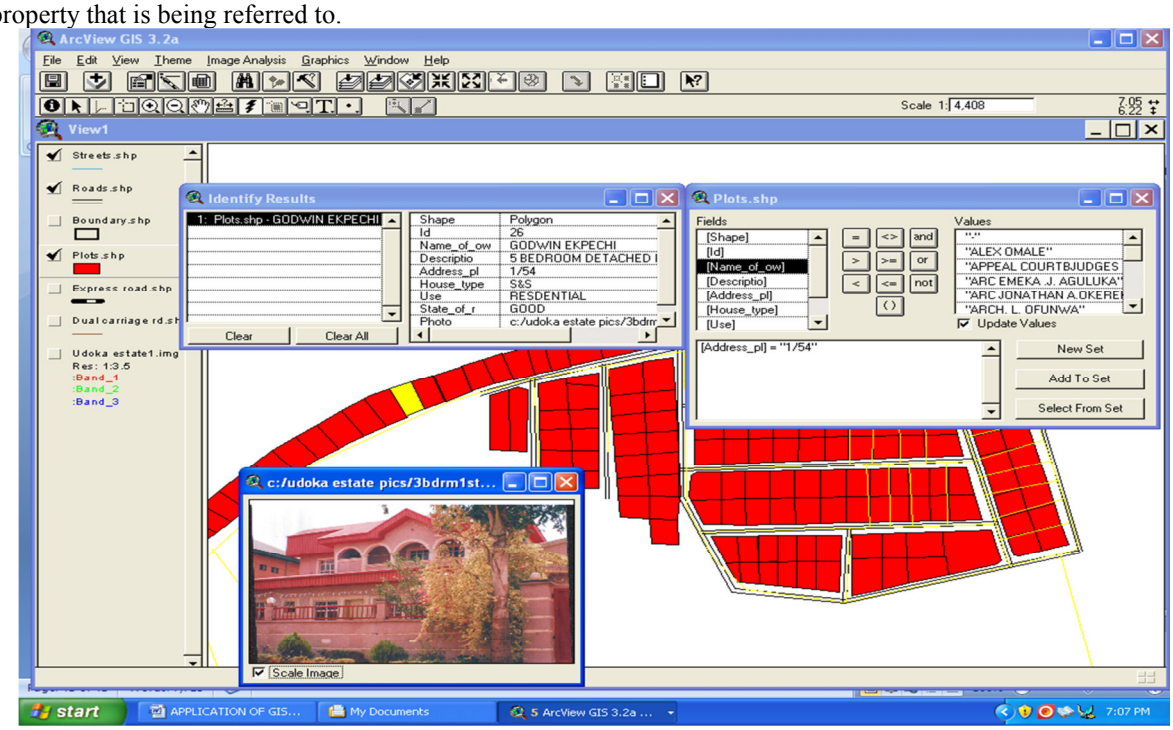

Fig. 7: Query attribute and hotlink image of a property

The aim of any GIS project is to aid in decision making using certain parameters set by the user. In housing estate management, certain operational decisions are usually required to be made promptly, but because of the limitation of the analogue system as currently practiced, there is a delay.

A client looking for a three-bedroom residential bungalow, whose state of repair is good, will have the search tailored to his need, as illustrated in fig. 8. This was achieved by querying the data using a query builder and within seconds the result is shown. A typical photo of the prototype bungalow found in the estate is also shown.

Apart from the linkage between plots and their attributes which this has enhanced, it has provided a means of updating records accurately and speedily.

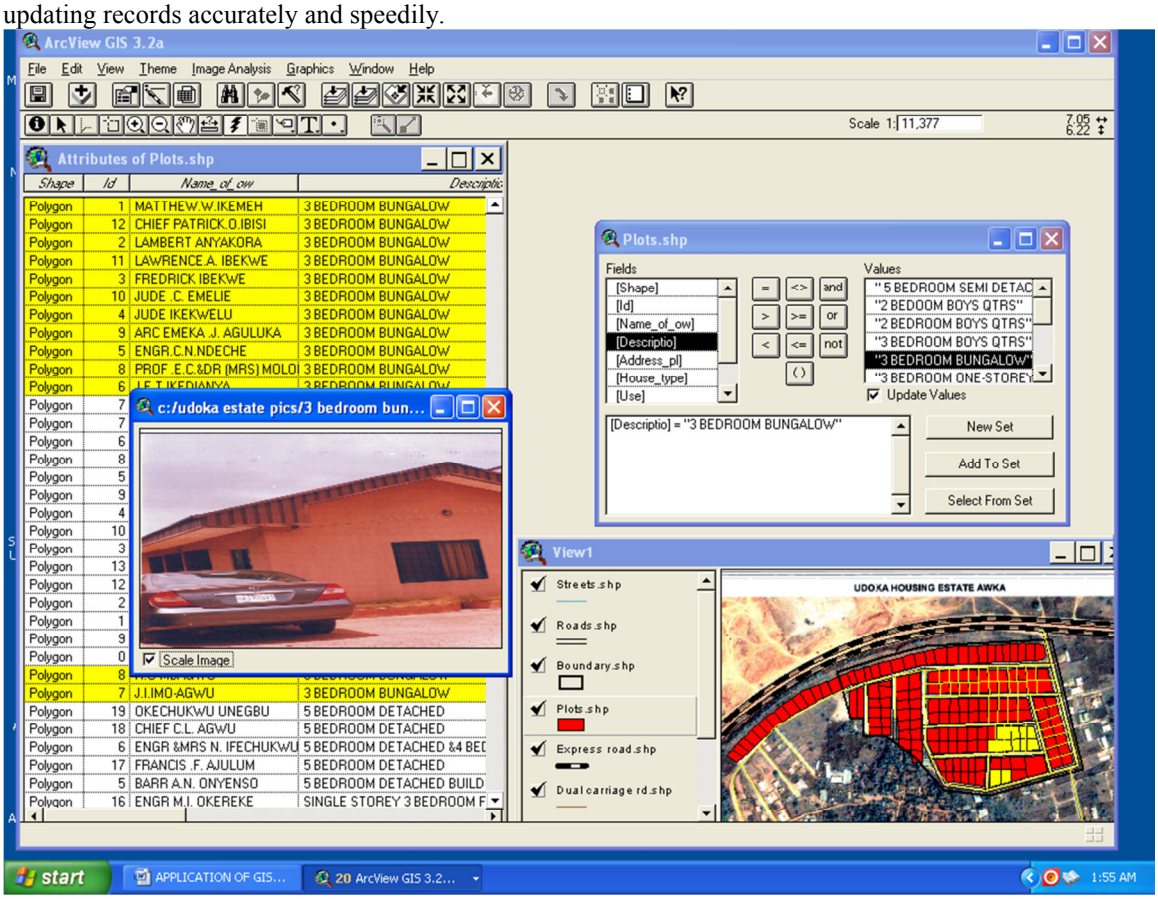

Fig. 8: Query showing three-bedroom bungalows used for residential purposes, and are in good state of repair in the study area.

Consequently, highly effective geographic distribution analysis can be performed to enhance management and strategic planning tasks which may include vetting of allocation lists, plot size, financial commitments of residents, creditors/debtors as per estate fees, service charges etc.

6. CONCLUSION AND RECOMMENDATION

Looking at the present situation in estate management in Anambra State Housing Development Corporation, it is evident that it is largely done with the analogue system and thus requires a lot of time to execute functions. The way business is done the world over has changed. Now, there are management support tools, geoinformatics technology being one of them, to aid speedy access to information retrieval in real time. In addition to a picture being worth a thousand words, the real value adding component of GIS technology is in data assembly and analysis as it allows one to integrate otherwise disparate databases (Castle, 1995). The structured query language (SQL), in the Arc View environment is very useful in the database for prompt actions instead of poring over files with the attendant consequences. With the application of GIS, and results being displayed on maps, one can find out the housing types in the Estate, owners of properties, properties state and repair condition etc. This provides improved information in housing Estate management. The application of GIS to property management makes for faster and effective handling of huge and complex real estate datasets. Finally, GIS brings about reduction in overall costs, up-to-date large-scale maps, which will have many uses and an improved basis for gathering statistics on land and property.

From these findings, the following are strongly recommended;

- Geoinformatics technology should be implemented or embraced in housing estate management for maximum benefits.
- Departments that engage or deal in housing matters should be equipped with GIS tool and expertise, such that their products will be up to standard and maximum success can be achieved
- Before a housing estate is developed, a proper surveying and consequent digitized map of the area should be achieved, to bring all the component parts to bear. Consequently, cadastral information and its accurate registration is a necessity for effective estate management as such maps will act as the basis for linking attribute data.

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