Cadastral Information System for M.I. Wushishi Housing Estate.

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Abstract
This study presents the possibilities for efficient implementation of a Cadastral Information System for M. I. Wushishi Estate in a GIS environment. Logical and Physical models for the Cadastral Information System were built and utilized in the creation of the Cadastral Information System using an Entity relationship model.

Keywords: Cadastral, Information System, Estate

1.0 Introduction
Considering the fixed nature of land compared to the continually growing human population with her multiple interests in Land, it becomes pertinent that Land be properly managed by the government for the common good of all. Efficient Land administration and Management therefore begins with the creation and maintenance of an up-to-date record of all occupiers of Land and their interest in Land. Such as register of land occupiers, their boundary and interest in Land form a basis for a Cadastre.

The Cadastre is simply a public catalog that is arranged methodically which contains information of properties within a locality based on information that is gotten from Cadastral Surveying Data. Cadastre is a system that exclusively connects a defined parcel of land (Ndukwu, 2013). Digital Cadastral Databases (DCDBs) are very dynamic since they are tied to daily changes in the cadastral framework through the subdivision and the land titling processes (Effenberg and Williamson, 1997). In essence, cadastre furnishes the public with both spatial and attributes information about a parcel of land.

The Food and Agricultural Organization (2006) describes cadastre as a ‘scientific term for a set of records showing the degree, value and ownership (or the basis for use or occupancy) of land. It provides a ready means of precise description and identification of particular pieces of land and it acts as a continuous record of rights in land’.

A cadastre (in Continental Europe), is perceived as a systematic and official description of land parcels, which includes for each parcel a unique identifier. The description includes text records on attributes of each parcel. The prototypical means of identification is a large-scale map that provides information on parcel boundaries (Silva and Stubkjaer, 2002).

Being an integral component of the overall Land administration process, computerisation of land records is therefore the first step towards making digital cadastre possible as far as Land record management is concerned (Tembo and Simela, 2004)

The Cadastral Information System therefore stands as the commencement point in the building of any relevant statewide cadastre. The Cadastral Information System contains the geometric description of the properties which forms the building block of the cadastral information system as well as additional information like: the people, occupants and the value of the property. The establishment of fully functional digital cadastral databases will help provide a proper information system that will facilitate development in an ever changing world of technology.
This paper presents a GIS based approach for the creation of a Cadastral Information System for M. I. Wushishi Housing Estate, along Eastern Bye-pass, Minna.

2.0 Study Area
M. I Wushishi is located along the Eastern Bye-pass of Minna – Town in Niger state, with a land area of approximately 58.5 Hectares. Built by the Niger State Government to ease accommodation pressure amongst middle income earners within the state and the sale of the estate enjoys adequate patronage. Considering however the extent of the estate, appropriate and up-to-date geospatial-database of all residents and their occupation is essential to mitigate possibilities of in-security within the estate.
3.0 Methodology
The design of the Cadastral Information System was done in stages as listed below:

3.1 Logical Design
Logical Design encapsulates both the logical design and data abstraction phases.

The process of logical design involves arranging data into a series of logical relationships called entities and attributes (Oracle8i Data Warehousing Guide Release2; (8.1.6) Part Number A76994-01). An entity idealizes a piece of information while attributes are components of the entity that define the uniqueness of the entity.

In relational databases, an entity is depicted in tabular form with each entity recorded as a field and the attributes along the tuple. During Logical Design, an ER diagram is drawn to depict the workflow. Drawing an entity-relationship diagram aids understanding of the organization’s data needs and can serve as a schema diagram for the required system’s database.

All required attributes of the entity were thus identified and linked appropriately in the ER diagram to facilitate easy building of the database.
Thereafter, the ER Model is mapped unto a relational database as shown in Figure 3:

3.2 Physical Design
This is aimed at creating physical relational database tables to implement the database design (Haithcoat, 1999). The required hardware, software, file structures and system memory requirements for execution are put into consideration and implemented as appropriate.

In building a Cadastral Information System, the process involves the procedure of building every other database systems i.e. software, hardware, data, procedures, database access language e.t.c.

To facilitate the database creation, real-time GPS was used to pick the co-ordinates of the bounding points of the entire area. With a base station established at L40, the rover was moved round the boundary points of the study area to determine precisely their co-ordinates to an acceptable accuracy level. Thereafter, a google-earth imagery covering the study area was acquired and geo-referenced with the boundary co-ordinates earlier determined using Simple Helmert Transformation. The fully geo-referenced image was then digitized as appropriate (flat by flat) to create the full spatial database of the study area.

Questionnaires were then circulated to all residents to fill in their personal information as regards their
full names, occupation, number of children, source of water e.t.c. An example of the circulated questionnaire is as shown in the appendix. Also, other non-spatial information as the type of roof, external wall painting e.t.c were observed and recorded accordingly.

3.3 Relational Database
A relational database is such which is perceived by the user as a collection of two-dimensional tables. They are manipulated a set at a time, rather than a record at a time and in advanced cases the SQL is used for its manipulation (Haithcoat, 1999). The ArcGIS software was used to build the spatial and aspatial database for the study area. With the spatial data represented in their appropriate geometric forms, the relational database table was used to link the spatial data with the attributes for each parcel.

4.0 Results
A parcel based Cadastral Information System for the study area was created comprising all parcels in their appropriate geometric representation viz-a-viz the entire land extent as shown in figure 4.
4.1 Multi – Criteria Queries

The database created is then used for implementing several selection queries in determination of user-defined requirements such as parcels whose occupiers are actual owners, occupier’s occupation, number of residents in each flat, selection of unoccupied flats and other such security – related questions.
Figure 7: Screen-shot showing results of multi-criteria query selecting number of 2 Bedroom buildings on Gurara Road with occupants less than or equal to 5.

Figure 8: Screen-shot showing results of multi-criteria query selecting number of Unoccupied 2 Bedroom buildings within the estate.
Figure 9: Screen-shot showing results of multi-criteria query selecting number of Unoccupied 3 Bedroom buildings within the estate.

The result shows that there are no un-occupied 3-bedroom buildings within the estate. This will inform the authorities of the estate that subsequent developments within the area should focus more on 3-bedroom building rather than 2-bedroom buildings.

5.0 Conclusion

This study has presented the possibilities for efficient implementation of a Cadastral Information System for M. I. Wushishi Estate in a GIS environment. Logical and Physical models for the cadastral Information System have been effectively built and utilized in the creation of the Cadastral Information System using an Entity relationship model. Such Information System has proven efficient for:

1. Property Valuation within the estate.
2. Residents Inventory for efficient security maintenance.
4. Property leasing analysis.

References


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