Cadastral Information System for Title Management in Nigeria.

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ABSTRACT

Population growth and economic development in Nigeria have created an exponential increase in the demand for land for various purposes. Consequently, the information requirements for land title administrations have increased. Yet the system of information collation and retrieval has remained, in most cases, unchanged leading to haphazard development of land resources with serious legal, planning, economic, and environmental impacts. This realization led to the involvement of Information Technology (IT) tools, to assist in the creation, documentation, and management of land titles. This paper describes a database application model to improve the situation. The methodology, operation, and evaluation of the system are discussed. The paper concludes that the system will provide reliable and easy system for collating information, analysis, retrieval, and monitoring trends pertaining to any particular plot of land which is invaluable for efficient land title management in Nigeria.

(Keywords: geographic information system, GIS, Cadastre, programming language, land title, schema, certificate of occupancy, C of O)

INTRODUCTION

Land administration is the process whereby land and information about its ownership is effectively in the control of a central authority that regulates the structure and patterns of land ownerships, land use, and access of the public to land resources in such a way that it is used in a sustainable manner from both environmental and economic perspectives. An ideal land administration must be able to include the provision of information on land in an effective and efficient way to correctly identify those people who have interest in real estate and providing information about these interests (such as duration of leases). It must also allow easy access to land for development where it is needed, increase efficiency in land use management through good planning, and promote greater social equity. It should also allow for revenue generation to the government (taxation), maintenance of environmental quality, and provide security of tenure.

In Nigeria's cities, land administration is devoid of the efficiency attributes indicated above. A number of problems are encountered in the current system. Prominent among these is the lack of a centralized database that is easily accessible. Also, International and landing agencies worldwide are increasingly recognizing the importance of improving the operation and management of cities in developing countries. A key component to this improvement is the use of Land Information Management (Willie, 1998).

The United Nation (UN), (1996a 1996b) sponsored inter-regional meeting of Cadastral experts in Bagor, Indonesia declared its vision as "to develop modern cadastral infrastructures that facilitate efficient land and properly markets, protect the land rights of all and support long term sustainable development and management".

In Nigeria, Cadastre started in 1883, yet the problem of management has increased over the years. In Northern Nigeria, much land exists that is not indisputably held by anyone. Of the land held under some sort of title, the greater portions are under customary tenure that has never been encoded and is known to vary in significant respect from place to place. Such title is unregistered and reliant upon only the knowledge of the community elders. Yet, as the slogan has it, the land is the nation's lasting resource and inheritance of future generations. However, its present use is subject only to controls that even urban planning authorities have trouble in enforcing. It is no wonder that it has been

observed that the pattern of growth in most cities of Nigeria consist of built up areas intermingling haphazardly with farmland and unused open spaces. More significant and conspicuous ramification of this is the absence of environmental safeguards in the use of land.

Importance of Cadastral Information and Land Information Systems

A land parcel is the basic unit for access and control of land, as well as land use decisions. Current, reliable land information is necessary for many public programs, for land planning, and for infrastructure development.

Land Administration In Nigeria – Current Issues

Land administration and management in Nigeria is presently bedeviled with poor remuneration, poor conditions of service, and inadequate logistics; lack of transparency in work processes, delays, and cumbersome manual procedures; poor records management; perceived corruption; mistrust on the part of customary land owners in land administration generally; lack of technical expertise in new technology available; and lack of effective collaboration and cooperation between the agencies. Thus, Nigeria's land management presents formidable challenges to the land administrator, the planner, the surveyor, the lawyer, the sociologist, the environmentalist, and the economist, especially in an environment where baseline data is scant. The lack of adequate functional and coordinated land information system and networks underpins this weak system, requiring that land related agencies maintain up-to-date scientific data, maps, and plans.

THE DATABASE APPROACH

A computer-based land administration system will force standardization in the collation and processing of land data; decrease the cost and space required for storing records; prevent unnecessary duplication; facilitate access to land related data; improve information distribution, reduce the time and cost involved in transferring property rights, processing mortgages, facilitates the monitoring and analysis of market and rental value of land and property; and provide built in mechanism for quality control.

The system will permit the integration of records of land ownership, land values, and land use with sociological, economic, and environmental data in support of physical planning. This will allow spatial analysis of any kind - this is the power of the system as a generic tool.

The use of a database system will allow managers to re-examine their current procedures and thereby improve delivery. It will also permit better monitoring of organizational performance, providing information on what is happening on the land in a better way so that problem areas are identified and appropriate remedial measures applied.

METHODOLOGY

A Database Management System was used to accomplish this study. Specifically, a Structured Query Language (SQL) database containing information that describes or defines a plot of land among several others within a layout was designed. The SQL database has a client/server relationship whereby other stakeholders from a distance could access it. Interfaces which are user friendly were used for the purpose of extracting the required information of a particular plot within a particular layout, in such a way that every plot involved would have its information coded, and displayed when needed from the database.

SYSTEM REQUIREMENTS AND SPECIFICATIONS

Requirements Specification: This is the process of understanding the external or functional nature of a system to meet some set of requirements or standards. The functional nature of this management system may be divided as follows:

- **Surveying Purposes-** The surveyors could use the system for reconnaissance purposes so as to extract some data that may be used in the field.
- **Administrative Purposes-** Land administration, this is for the final issuance of Certificate of Occupancy (C

of O) to Titleholders, which guarantees ownerships.

- **Planning-** The Planners whose main concern is the design of Layouts and continues monitoring of physical developments could as well utilize the system for their planning scrutiny.

To achieve the stated requirements various tables and menus interface are created for the user to use.

DATAFLOW DIAGRAM

The primary method of representing and communicating system information is through models. Data flow diagrams are one of the modeling tools commonly used. A data flow diagram provides a special way of looking at the computer information system, emphasizing the flow and transformation of information. Figure 1 is a general outline of the flow- chart of this information system.

The database schema is aimed at developing a database that would be used in land organizations to manage and acquire land related information. The schema not only defines what columns go in which tables; it also shows the logical relationship between the entities being held. According to the schema shown, the Commissioner Table contains all the information related to the details of the Commissioner that approved the particular layout. The Surveyor Table shows all the information of the Surveyor that demarcated and surveyed the particular layout. The Planners Table also displays the details of the planner that designs the layout. There is also the Layout Table that reveals the details of the layout itself. The Local Government Table tells us the layouts that are at specific local government areas. The Plot Table explains the Information that defines the plot. The Owner Table displays some personal information related to the owner. There is a PlotInfor Table that gives us additional plot details.

The database is supposed to be a central database located in a Survey Department and being accessed from both Planning and Land departments simultaneously. Shorthand representation of the database Schema, is as follows:

Commissioner (CommIDNo, FirstName, MiddleName, LastName, Sex,DateofBirth, Rank, TelNo)

Surveyor (SurveyorIDNo,FirstName,MiddleName,LastName, Sex, DateofBirth,Rank, TelNo)

Planner (PlannerIDNo, FirstName, Middlename, LastName, Sex, DateofBirth,Rank, TelNo)

Layout (LayourNo, LayoutType, CommIDNo, IndexSheetNo, Purpose, Location,Density, Scale, LocalGovtCode, PlannerIDNo, RecommendationDate,ApprovalDate)

LocalGovernment (LocalGovtCode, LocalGovtName)

Plot (PlotNo, LocalGovtCode, LayoutNo, Area, Scale, PlanNo, Value, Purpose, SurveyorIDNo, PlotType)

Owner (FileNo, FirstName, MiddleName, LastName, TelNo, DateofBirth, Sex,LocalGovtCode, Street, Town)

PlotInfo (FileNo, PlotNo, DateofGrant, PeriodofGrant, GroundRent)

In a State, the Land Ministry has the statutory right of Land allocation and management of all the plots within its area of jurisdiction. In trying to execute the above mentioned task different professionals and executives group together and render their services one after the other.

According to the above schema, the Commissioner, the highest executive officer within the Ministry, can give the directives for the design of Layout(s), which contains the plots shapes, sizes, types and some other details that make the layout peculiar. So, one Commissioner can ask for the design of many layouts. The Planner, the professional who physically designs layouts, having received the directives then embarks on physical design. He can design many layouts as such one Planner can design many layouts.

The whole State is divided into many Local Governments, where these layouts are to be located. In one every Local Government there are many layouts, thus the relationship is one to many. Every layout contains many plots that would be allocated to Owners so the relationship is one to many. Similarly, many Owners could own a plot (e.g., by inheritance) and an Owner could own many plots (an estate). This presupposes the many to many relationship, which necessitates the formation of the PlotInfo-Table, whose relationships with both Plot-Table and Owner-Table are many to one.

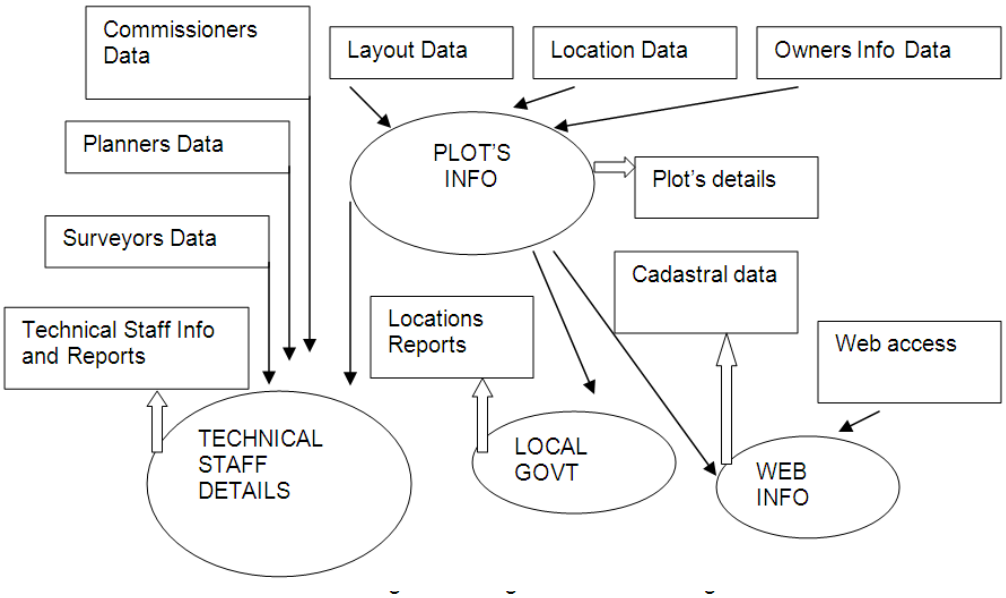

Figure 1: Data Flow Diagram.

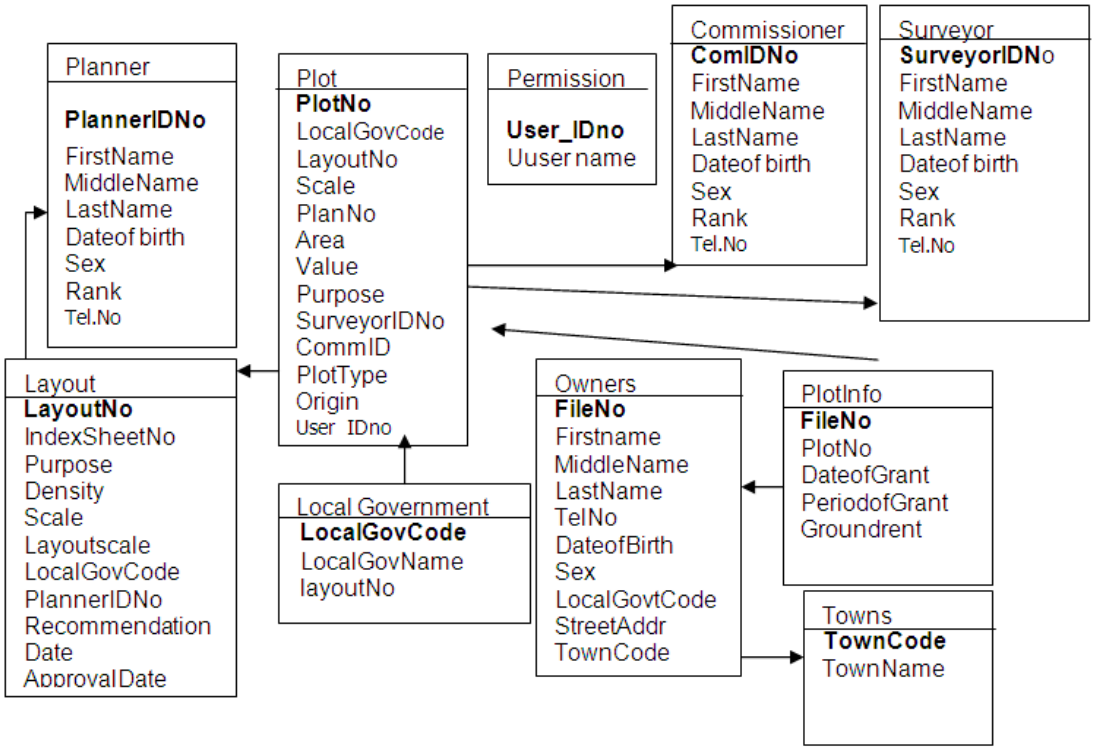

Figure 2: Schema for the Global Relationships.

Furthermore, there are many Owners of plots in one LocalGovernment, therefore the relationship many to one exists between the two tables.

Finally, the Surveyor, who demarcates the Plots on the ground, could survey and demarcate as many plots as possible, so the relationship between the Surveyor-Table and the Plot-Table is one-to-many relationship. In a nutshell, this kind of database could be used to display the technical information of one's plot (File number, Layout number, Plan number, Purpose, Area, Value, Scale, etc.); the details of the executives and the professionals that participated in its design and demarcation; how many layouts are there in a particular Local Government; how many layouts were designed by one planner; How many plots are for residential, commercial, agricultural, or industrial purposes in the State; how many plots were surveyed and demarcated by one surveyor, etc.

The database could also tell the total number of plot owners in the State and how many are male or female. The output information of this database is not only very useful for managerial and planning purposes for the issuance of C of O to landowners but also very useful for statistical and court litigation purposes.

DATABASE DESIGN

The first is the actual SQL database design followed by the development of the applications that uses the database. The application is an integration of land Information database with an application program that manipulates the stored information. The database design involves logical and physical design and is adopted because of the following superior capabilities over the traditional methods.

- Data could be shared among several users without duplication
- The data source could easily be protected so that it is secured, reliable and consistent
- The DBMS clearly defines the data and their relationships
- There exist an independence between the database and the associated applications

The objectives of the database are also highlighted below:

- To satisfy information contends requirements of specified applications and users
- To provide a natural and easy structuring of information
- To support processing requirements

CONCEPTUAL DESIGN

The Entity-Relationship strategy is adopted for conceptual modeling of the applications. This is a high level DBMS independent model that uses user's requirements abstracted from the analysis stage. It includes descriptions of data types, relationships, and constraints.

The Entity-Relationship modeling technique is a top-down approach that follows the following sequences:

- Select entities and relationships between them that are of interest to the enterprise
- Assign attributes to the entities and relationships
- Represent them in graphical form. This is what is called the E-R Diagram

Database Schema for the Main Global Relationships

Having identified the different entity sets, the attributes and the relationships of the Cadastral information, the following main E-R diagram was constructed as shown in Figure 2.

Entity Identification

The requirements analysis of the applications identifies the existence of nine regular entities. These are Plot, Planner, Surveyor,

Commissioner, Layout, Plotinfo, Owner, Localgovt, and Town.

IMPLEMENTATION DESIGN

The implementation design phase involves the mapping of the E-R schema onto the relational schema. The following are the mapping strategies used:

1. For each regular type E in the E-R diagram, a relation R was created which included all the simple attributes of E. Then one of attributes was chosen as PRIMARY KEY.

2. If the relationship is many to many, then a Joint-Table is created with both keys being the key attributes of R.

3. If the relationship is many to one from entity set E1 to entity set E2, then the key attributes of E1 are the key attributes of R, but those of E2 are not.

4. If the relationship is one to one, then the key attributes for either of the connected entity set are the key attributes of R. Thus, there is not a unique key for R.

E-R RELATIONAL MAPPING

From the System E-R diagram nine regular entities were identified. Using the principle (1) above, other relations were formed.

RELATIONAL DATABASE

Relational database schema refinement is aimed at getting an appropriate structuring of data storage, in such a way that there is sound performance. The main emphasis is on designing quality relational schema, which would ensure the following:

- Retain and maintain the semantic values of the attributes: this is to ensure that each schema correspond to one entity type or relationship

- Reduce redundant values in tuples: this could minimize the data storage space, which the relation occupies. Normalization reduces redundancy in a database

- Reduce null values in tuples

- Disallow spurious tuples

USER INTERFACE DESIGN

The System uses a graphical user interface for interaction between the user and the computer system. Forms provide a user-oriented interface to the data in a database application. They allow developer, to specify in detail the appearance and behavior of the data on screen and to exert a certain amount of control over the user's additions and modifications to the data. Like queries, forms do not contain any data. Instead, they provide a "window" through which tables and queries can be viewed.

DESIGN CONSIDERATIONS

In designing the interface a number of considerations were observed in mind:

- The interface was made to simple and user friendly bearing in mind that some users are computer novels or amateurs

- The interface incorporates confirmation dialogue boxes that are used to confirm an action thereby avoiding accidental data destruction

- Consistency in the use of the terminology

DATA ENTRY SCREEN INTERFACE

Password Authentication

A password was used to gain access into the system to avoid unnecessary intrusion. This is achieved by the use of the PASSWORD table in the SQL database. User must seek or apply for the permission to access the System. So the system administrator uses his own prerogatives to grant the permission. Figure 3 shows the interface for login.

Figure 3: Login Interface.

The Menu

This is the basis of the interface design and it is accessed once the user logged in. All other interface components interact with the users through the MDI (Multi Documents User Interfaces) menus. A menu is employed so as to organize the applications components with a view to making them more accessible to the users. Under the menu are the sub menus.

Other Data Entry And Viewing Screen Interfaces

Data for the system was entered through the designed interfaces with a carefully selected coloration to add to its esthetic quality. A sample for the Commissioners information is shown in Figure 4. From the figure, it could be seen that the user could add, delete, and update data. User could as well navigate through the bulk of data in the table so as to view the information.

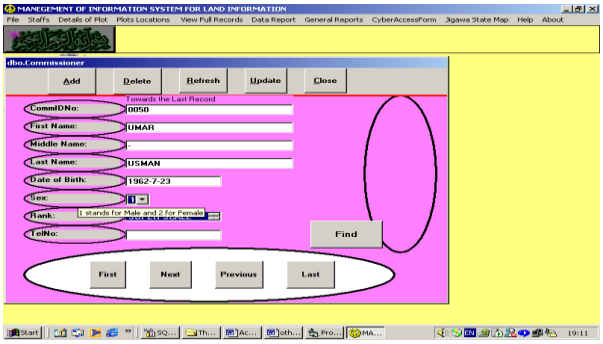

Figure 4: Data Entry Interface.

Reports

There was also a report, which was a formatted form of database data and may be needed from time to time for information analysis by the management personnel. At times reports are given to titleholders for their usage.

CONCLUSION

Although most Cadastral Information Management Systems are in form of Geographic Information System (GIS), the use of SQL database technology coupled with the Visual Basic programming language proved productive. The later could not only be easily managed but would also be cheaper to produce and maintain as such suitable for developing countries where the comprehensive and complex GIS for the management of Cadastre may not be readily available for usage.

This design that described a prototype model proves simpler and cost effective for processing of client requirements on land management matters. The underlying methodology, development, and operation of the prototype have been simplified for easier comprehension and operation. Consequently, the problem of lack of expertise to operate and manage the systems has been completely eliminated. While it is evident that the application is potentially useful tool for client requirements processing, further improvements (e.g., to the user interface) and extensions incorporating other complex requirements, or integrating with other packages, etc., could no doubt, enhance its effectiveness in contributing towards the complete satisfaction of client requirements.

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