LAND INFORMATION SYSTEM (LIS)
WITH AUTOCAD AND MICROSOFT ACCESS

Case Study: Dept. Of Land, Planning & Survey,
Federal Capital Development Authority (FCDA),
Abuja.

BY

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PGD/MCS/98/99/739

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SEPTEMBER, 2000

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A project submitted to the Department of Mathematics and Computer Science in partial fulfillment of the requirement for the award of Post Graduate Diploma in Computer Science of the Federal University of Technology, Minna, Niger State, Nigeria.

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ACKNOWLEDGEMENT

CERTIFICATION

I certify that this project was carried out by Julius Bala Machu Sambo of the

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Sign _____   Date _____
       Dr. S. A. Reju
     (Project Supervisor)

Sign _____   Date _____
       Dr. S. A. Reju
   (Head of Department)

Sign _____   Date _____
     External Examiner

DEDICATION

To my aged parents Mr. & Mrs. Machu Sambo, my Darling Wife Mrs. Ladi Sambo and my children Master Maru Machu, Miss Inti Machu, Miss Ture Machu and Master David Machu.

ABSTRACT

Land has often been identified as the primary resource from which wealth is derived. But the resources of land are neither inexhaustible nor indestructible. Professionals with interest in land and land matters are therefore saddled with the responsibility of managing one of the most expensive earth's scarce and delicate resources - land. Documents pertaining to the holdings in land need to be kept and managed with utmost care.

LAND INFORMATION SYSTEM

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CHAPTER ONE

INTRODUCTION TO LAND INFORMATION SYSTEM (LIS)

1.1   Preamble

Land can be defined simply as the space for human activity on, above and beneath the earth surface. It encompasses all those things associated with the surface of the earth including those areas covered by water. In other words, land is the foundation of all human activities: from it we obtain the food we eat, the shelter we need, the space to work and the room to relax. Dale and McLaughlin (1988)[5]

Land has often been identified as the primary resource from which wealth is derived. The resources of the land are neither inexhaustible nor indestructible. Professionals with interest in land and land matters are therefore saddled with the responsibility of managing one of the most expensive earth scarce resources, which is land. Documents pertaining to the holdings in land need to be kept and managed with utmost care. Adeoye (2000)[1]

For effective, thoughtful and careful stewardship of land therefore, detailed information about it is required. Information is recognized as a resource that can be used in the creation of wealth. The acquisition and effective use of information are also fundamental to the survival of any organization, however large or small. Dale and McLaughlin 1988)[5]

Information here is defined as any data that is processed into a form suitable for the user. Information system is a combination of human and technical resources, together with a set of organizing procedures that produces information in support of some decision-making requirements. It is arguable that better information increases the chances of making and implementing better or successful decisions in any organization. Dale and McLaughlin (1988)[5].

Land Information System (LIS) involves spatial (Geo-referenced), graphical and textual data acquisition, processing, storing, retrieval and distribution of information

about parcels of land. A system that renders support to land management by providing parcel-based information about the land, the resources upon it and the improvement made to it.

Pragmatically, Land Information System (LIS) is also considered as any data or knowledge about the legal, economic and physical aspect of the land, on, above or beneath the earth surface. This knowledge or information may be presented in the form of Maps/Plans, Chart, Tables or other documents used for decision-making support in land management.

Computerized LIS is one or several computer registers containing information about land, buildings, infrastructure, etc. and a computerized base map. By recording geographical coordinates for land, buildings, infrastructure, etc. such that all these information is linked together and presented as computer printed overlays on the base map. Muller (1988)[11].

1.2   Overview of The Case Study

The Federal Capital Development Authority (FCDA) is an organization, which was established in October 1975 through a Federal Decree and charged with the development of a new Federal Capital for Nigeria. This was necessary due to the following problems identified with Lagos:

i)   It is incapable of functioning as both a Federal Capital and a State Capital due to limited land space;

ii)   It is predominantly one ethnic group in a Country of over 300 ethnic groups;

iii)   It is not centrally located in the Country;

iv)   It could not serve as a symbol of national unity and greatness.

A committee which was set up by the government of late General Murtala Muhammed and charged with an examination of the Capital City's relocation, had recommended that,

> " A centrally located Federal Capital in a spacious area with
> easy access to all parts of the Federation would be an asset to

the nation and would help in generating a new sense of national unity."

On accepting the recommendation, the Federal Government, through Federal Capital Decree number 6 of February 1976, set into motion an accelerated programme administered by FCDA for the comprehensive planning and development of what is projected to be one of Africa's great new Cities of the time. IPA (1979)[6].

The site of the Federal Capital Territory (FCT), as recommended by the committee and defined in the FCT Decree of 1976, is an area of 8,000 square kilometres south of Suleja and surrounded by Niger, Kogi, Nassarawa and Kaduna States. (see figure 1.1). The Federal Capital (FC) is central to Nigeria, lying just above the hot and humid low lands of the Niger/Benue trough but below the drier parts of the Country lying to the North. It lies just north of the wide alluvial plains formed by the confluence of the Niger and Benue rivers. The Jema'a platform, a continuation of the Jos plateau, extends well into the middle of the territory. IPA (1979)[6].

Figure 1.1 **FCT SITE**

1.3 The Established Functions Of FCDA

As contain in the Master Plan for Abuja, FCDA was established by decree and charged with the development of a new Federal Capital for Nigeria. This resulted in the location and formation of the FCT, encomprising and the New Federal Capital City (FCC) and Regional Settlements in the Territory.

In addition to the established functions of organizational and substantive city building, FCDA has become an operating administrative entity with responsibility for city operation, maintenance, rehabilitation, and continuing growth. Institutionalizing the planning and administrative process on a continuous basis under an appointed Federal cabinet Minister. IPA (1979)[6].

This position has placed FCDA in a municipal management status, required for proper administration of planning and development for both the un-urbanized area (Regional territory) and the New FCC. To achieve these set objectives the Authority has the following departments: Departments of Legal Services, Personnel Services, Finance and Supply, Public Buildings, Engineering Services, Health Services, Education, Land, Planning & Survey, Planning, Research and Statistics and the department of Maintenance. The activities of these departments are controlled by Directors.
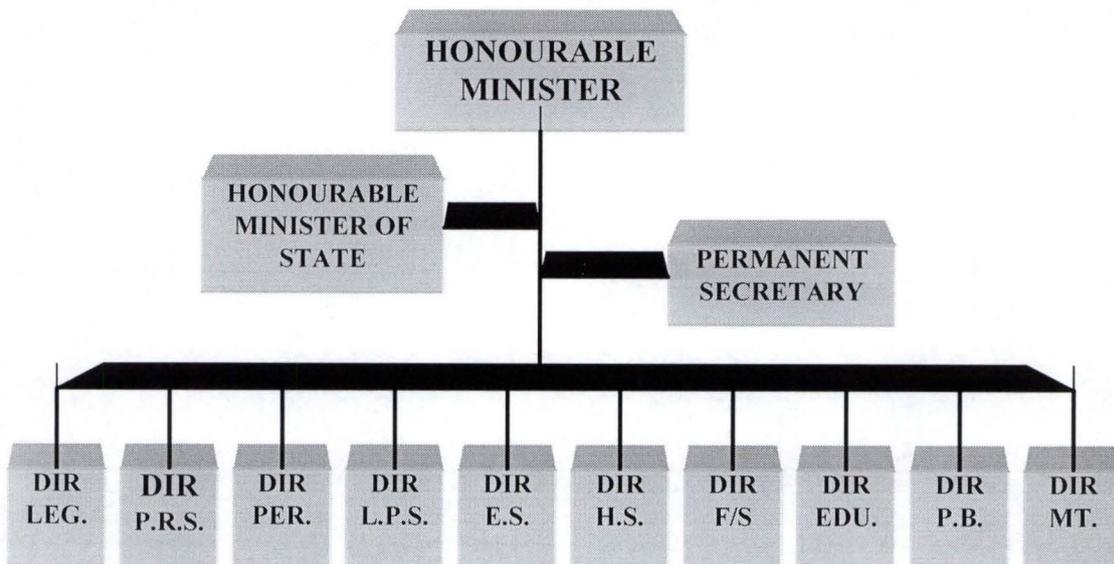
Figure 1.2 **FCDA DEPARTMENTS**

1.4   **Structure of Land, Planning & Survey Department.**

The department of Land, Planning & Survey is one among the arms of the Federal Capital Development Authority (FCDA), which is saddled with the responsibility of providing the framework for physical development of the New F.C. It is made up of six (6) technical and one Logistics division, which are directly in charge of the day-to-day operation of the department.

DIRECTOR LAND, PLANNING & SURVEY DEPT.

| DD REG. PLAN'G | AD LOGISTICS | DD URBAN PLAN'G | DD URBAN SURVEYS | DD LANDS | DD REG. SURV.EYS | DD DEVT. CONTROL |
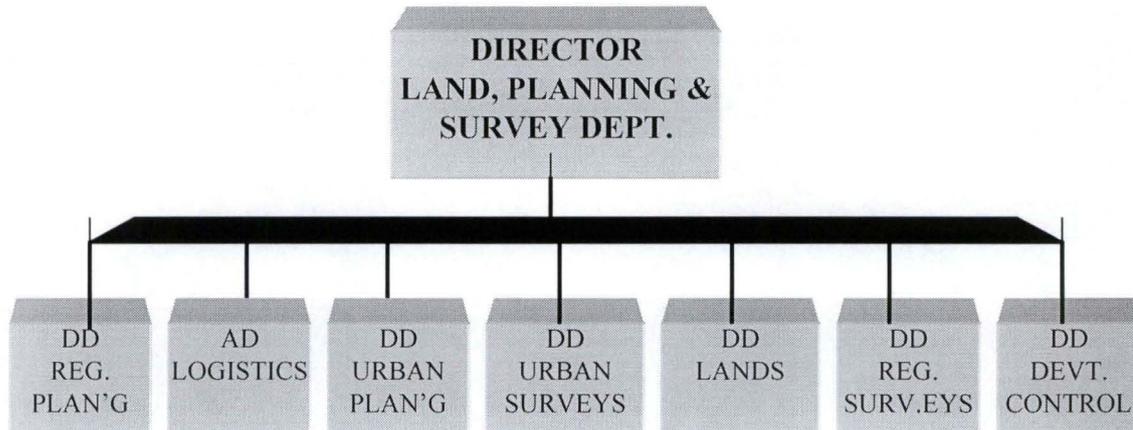
Figure 1.3   DIVISIONS OF LAND, PLANNING & SURVEY DEPT.

A Director who is answerable to the Honourable Minister of the FCT controls the operations of all these divisions. Functions of the divisions are geared toward providing the structures for successful implementation of the physical or real estate development plan, environmental and development monitoring, and management in the FCT.

These technical arms or divisions are:

      i)   Land Administrative division;

      ii)   Urban Planning division;

      iii)   Regional Planning division;

      iv)   Survey and Mapping division;

      v)   Regional Survey division;

      vi)   Development Control division;

Seasoned civil servants head each of these divisions in the capacity of Deputy Director, reporting directly to the Director. A directorate division in charge of all administrative procedures, operates directly under the Director.

Under the Deputy Directors (DDs) are Assistants Directors (ADs) with various specific responsibilities overseeing the activities of all other desk officers who are directly responsible for site supervision of the various tasks being executed by skilled technical staff.

1.4.1 Functions Of The Divisions

Land Administrative Division- This is responsible for all cases of land administration and transactions, which includes collection, recording, and storage of all legal documents relating to individual parcels of land. Also maintaining legal information about who owns the land, who occupies the land and what improvement is being carried out on the land value.

Urban Planning Division- This is responsible for physical planning of the FCC under the guide of the original master plan for Abuja, involving layout preparation of neighbourhoods or schemes in zones. This is done through site selection and planning or subdivision of selected sites into residential, commercial and industrial plots and layouts to be allocated to prospective land applicants/developers.

Regional Planning Division- This is responsible for physical planning of regional areas and settlements in the FCT, under the guide of the original master plan for Abuja, involving layout preparation of neighbourhood schemes. This is done through site selection and planning or subdivision of selected sites into residential, commercial and industrial plots and layouts to be allocated to prospective land applicants/developers.

Survey and Mapping Division - This is where the spatial or Geo-referenced framework is provided for all the planned zones and layouts. This provision is made before and after planning processes, through the provision of base maps upon which all planning processes are carried out and the emplacement of planned structures at the sites. Thus

maintaining the spatial records (geographical positions) for all plots and layouts in the cadastre where all technical records about plot ownership is kept. The division also carries out the production of Title Deed Plans (TDP), copies of which forms part of the certificate of occupancy booklets.

Development Control Division- This is responsible for processing application for building plan approval (BPA), monitoring and control of physical development as well as detection and demolition of all illegal and unsightly development within the FCC. In this manner, all land developers have to obtain building permission or risk their structure as illegal and marked for subsequent demolition.

Regional Surveys Division- This is where all the surveying activity of the regional centres or Area Councils is controlled. Each of the Area Councils has a team of experts comprising of Land Administrators, Town Planners and Land Surveyors and headed by a seasoned / qualified professional, designated as 'Zonal Manager'. These Zonal Managers report all their development problems or solutions to the DD/Regional Surveys, who scrutinizes it for further necessary action.

1.5   Aims And Objectives Of This Project

The aim of this project is to produce a workable and comprehensive land (parcel based) information system with the computer for many users. That is, a land information system that will be required in wide variety of activities. A system that answers query from Estate developers, Existing and prospective land title holders, Land Surveyors, Soil Scientists, Civil Engineers, Lawyers, etc. and agencies of all levels of government. Dale and McLaughlin (1998)[5].

It is important to add that this project is purported to serve not only the academic requirement for the award of PGD computer science but also to bring to limelight the possibility of using the computer to efficiently handle the large land information processing applicable to the land Department of FCDA through means available in-house.

The objective is not to rewrite what LIS is all about but how to achieve it through some selected computer applications that are common and affordable. Standard LIS programs do exist in abundance in the Survey industry but also do requires a lot of customization efforts in addition to inflexibility or rigidity in the desire operation.

Thus my intention is the establishment of a reliable relational database with Microsoft Access computer package and to integrate this database with AutoCAD scaleable graphics computer package through programming with Microsoft Visual Basic windows programming facility. And to achieve these through building a user/computer dialog interface with commands and pointer selection device.

1.6   Statement Of The Problem

From experience in computer usage and my PGD Computer Science training exposure, it is understood that all Microsoft Windows-based computer applications have a lot in common, including the ability to share data. But integrating Autodesk's AutoCAD - a computer scaleable graphic application, with Microsoft Access - a Relational Data Base Management System, to form a platform under Microsoft Visual Basic programming language, lies the problem.

1.7   Scope And Limitation

The scope of this project include the procedures beginning from designing a workable database for all plots of land, land applicants, plot allocations, certificates of occupancy, land revenue collection, etc. in the FCC, to exploring the database accessibility in AutoCAD, exploring the data access facility and the programming features in Visual Basic. Data collection, collation and capturing of textual, spatial and graphical through the keyboard and Scanner. Putting the program developed in Visual Basic into an independent executable (.EXE) file.

This project is limited to the use of Visual basic 5.0 as the programming interface to provide user control on the interactions of AutoCAD Release 14 with Microsoft Access version 7 or later (MS Access) - a component of Microsoft office 97 and later.

1.8   Relevance Of This Project

Land Information System (LIS) has been around ever since the time land ceased to be the exclusive right of the community. There has been the need to register rights of individuals over parcels of land coupled with increase in population in both urban and rural centres. Computerised and efficient LIS is the only way out of the chaotic situation this trend in rights-of-land and the increase in population could cause the crude method of manual land information processing and dissemination.

The fast growing Federal Capital City (FCC) with the attendant volumes of Certificates of Occupancy and land allocation letters issued out yearly from the 80s. And the present rate of influx of people and land applicants to the FCC, demands nothing short of computerized LIS on the modern day information technology (such as this project) so as to meet the requirements of the Department of Land, Planning & Survey, FCDA.

CHAPTER TWO

COMPUTER APPLICATION TO LAND INFORMATION SYSTEM

2.1 Introduction

Land Information System (LIS) could be akin to a multipurpose Cadastre - records or registration of right of land title holders, land value and use, which is maintained both in graphical (Maps/Plans) and textual (tables) formats. Dale and McLaughlin (1988)[5]. The format of LIS is different in the sense that all records (graphical and textual) are kept and maintained electronically in digital format in the computer. Which is an electronic device that is designed to take in or accept data, store it and/or process it (according to programs available to it) and produce more efficient, accurate and timely information useful to the user.

It is important to note that the mere fact of using a computer does not of itself mean that the work is done more efficiently or that better information is produced. Too often computers are introduced in an attempt to solve technical problem when the real problem is one concerned with Management, or lack of clear objective, or poor coordination or one caused by environmental change or some other factors.

To gain maximum advantage from using computer, it is essential that problems are clearly identified before computer system is introduced. This means that there must be considerable investigation into management's requirements, problems, information needs, and so on before there is any attempt to design a computer system.
Lucey, (1995)[7].

2.1.1 Requirements For Computer Application To LIS

These include Hardware, Software and the human-ware to achieve the desire LIS setup. The Hardware among others, are computer with fast processor and large storage facility capable of handling the spatial graphic data manipulation found in CAD programs, VGA (Video Graphic Adapter) monitor, a Mouse, a Keyboard, a Digitizing tablet, a Scanner, a high resolution printer and a large flat-bed or drum line or raster plotter.

The Software is, Computer Aided Design (CAD) Software, a relational database management system, word processing software and other office support software.

The Human-ware include experts in computer programming and maintenance, experts in environmental related discipline such as Land Surveyors, Town Planners Cartographers, Photogrammetrists etc., Computer database administrators and computer operators.

2.2 Land Information System Development

Similar to any information system development, LIS development has to be undertaken based on some solid procedures and measures necessary for the system to be acceptable and be useful overtime. This is particularly so in an organisation such as the department of Land, Planning & Survey of FCDA. As this is where the concentration on issues of land at the moment surpasses that of any other land Ministry or organisation within the country, Nigeria.

To develop a workable or useful computerised LIS, it is important to recognize that an information system is part of a wide management system. It must provide support and assistance to management for planning, control, decision-making and other functions. Lucey (1995)[7].

Thus information system development should start with an answer to the question - 'What ?' then 'How ?' and moving to the successive levels of detail. Lucey (1995)[7]. That is the decision that LIS must be carried out should be based on some clear-cut reasons. These reasons must be backed up with an analysis of LIS, then work out (Design) how to get it done before doing or developing it. Then get the system accepted and keep it working so as to answer the question 'How effective was it' and how to improve it. A system development life cycle is then evolved when the need for improving the established system has arisen.

As a new method of land information processing, storage, retrieval and dissemination, an attempt is made to adopt the Blumenthal approach to information system development, which include the following strategies:

a)   Structuring the information need according to the individual divisions/units of the department;

b)   Integrating the divisional information requirement to a single whole so that common data can be shared, eliminating data repetition and redundancy;

c)   Providing management with information that is fairly stable in terms of contents, level of detail, accuracy and frequency through a standardised database;

d)   Ensuring spatial, textual and graphical data collection, validation and analysis as a necessary strategy for the actualisation of the required information about plot of land;

e)   Designing a database or modeling the activity of the organisation - the most important aspect of information system development - into conventional computer files for easy processing, storage and retrieval;

f)   Implementing the total system-design and development, into a workable LIS application for the whole department. And to adapt to the new land information system application with ease and without hitches.

2.3   Data Base Management System

Database can be defined as a collection of structured data, such that the data is independent of any particular application. In other words, a database is a file of data structured in such a way that it may serve a number of applications without its structure being dictated by the applications. Lucey (1995)[7].

Databases are made up of records and each record has a number of fields, which gives specific details about the record. Database can grow and change as it is built up stage by stage within an organization. It actually comprises several databases, each providing the anticipated information for several related management information systems where the data can be accessed, retrieved and modified with reasonable flexibility. Lucey (1995)[7].

The database management system (DBMS) - is a complex software which constructs, expands and maintains a database. It also provides the link or interface between the user and the data in the database. Lucey. (1995)[7].

Users of database do not directly access the database. Instead, they accesses the Data Base Management System (DBMS) which interprets the data requirements into accesses to the database, makes the accesses required and returns the results to the user in the form that the user requires. Avison (1988)[3].

The ability to store and access vast amount of data in an efficient manner has made the system a useful tool to refine and improve activities at strategic, tactical and operational levels of any organisation. Lucey (1995)[7].

2.3.1 Distributed Data Bases

This is where database collected on individual computers are linked together in a Local Area Network to provide access to shared data in their various databases, so as to avoid duplicating the collection, validation and storage of these data. User could be linked such that all other member users on the network access all users' databases. The user will need to have access rights to these other systems. In this configuration, there is no notion of central computer. The users at different location are not just terminal users, they have intelligent machines with software to perform general data processing as well as software to access the database. Avison (1988)[3].

2.3.2 Database Machines

These are computer systems dedicated to database use rather than general data processing. They are designed to make database access as efficient as possible. This is done through the use of micro-coded database instructions to improve on the database access times. Such computers can be connected to one or more general-purpose computers for more performance. Avison (1988)[3].

2.3.3 Components Of DBMS

These are data definition and description software, data processing software and data enquiry software. The definition / description software defines and organises data, while the processing software manipulates and retrieves data. The enquiry software handles all forms of requests and ad-hoc enquiries. Lucey (1995)[7].

Data Input	Applicatn Program	Decision Sup't Sys.	Executive Info. Sys.	Ad-hoc Enquiries

Data Base Management System

Definition and Description Software	Processing Software	Enquiry Software
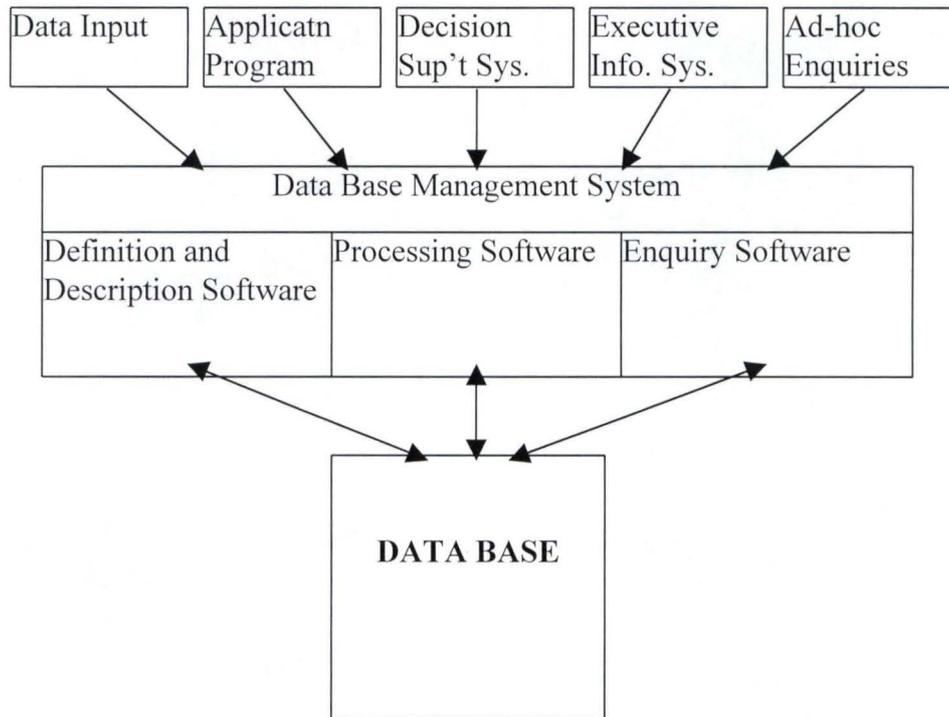
DATA BASE

Figure 2.1 - <u>COMPONENT OF DBMS</u> (Source: Lucey, 1995)

2.3.4 Types Of DBMS

Popular types of Database Management Systems include Relational, Hierarchical and Network. The relational DBMS makes use of relations or 2-dimensional tables with row and columns. The rows extends from left to right and contains the records or information about the subjects of the table, while the columns extends from top to bottom and contains the fields or the data elements of the subjects (records).

The hierarchical DBMS is built in a tree like structure. This system has an in-built linkage whereby there are owner (Parent) records, which own numerous member (child) records.

The Network DBMS is a further development on linkages. The linkage systems are

technically more efficient but do require greater data processing knowledge, so their use tends to be restricted to information specialists. Lucey (1995)[7].

2.3.5   DBMS In LIS

LIS, which is an application program, requires vast amount of data structured into database and maintained by database management system software to function properly. In other words, LIS is dependent on the availability of the database which can be manipulated by a database management system for the benefit of the user, through computer aided drafting / design (CAD) program.

LIS APPLICATION
COMPUTER AIDED DESIGN (CAD)
DATA BASE MANAGEMENT SYSTEM
DATA BASE
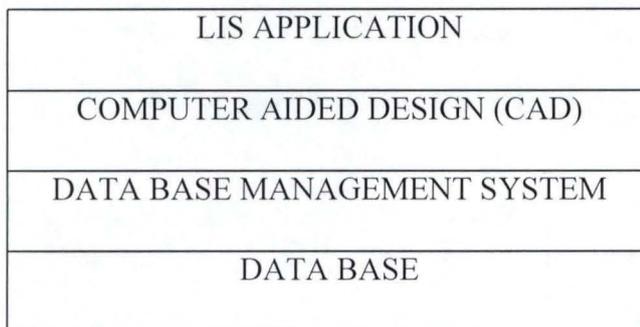
Figure 2.2- USE OF DBMS IN LIS

2.4   Microsoft Access Computer Package

Microsoft Access is a window based database management system developed by Microsoft Corporation, USA. It is a component of an integrated application software package known as Microsoft office, copies of which has been distributed free of charge with every new personal computer (PC). Microsoft Access is a Relational Data Base Management System, which stores and retrieve data and information according to relationship defined by the database designer or programmer. The icon of a key identifies MS Access.
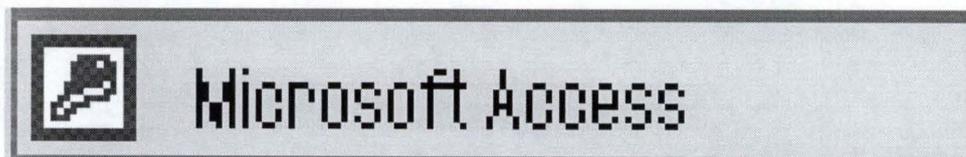
Figure 2.3 MS ACCESS ICON

Using MS Access, data is organised according to subject so that the data is easy to track and verify, and information about how different subjects are related is also organised so that related data can easily be brought together. MS Access has the same database engine and format as Microsoft Visual Basic. Databases created with MS Access can be used just if they were created directly in Visual Basic.
Microsoft Corporation (1997)[8].

MS Access database has several small tables much like the file containers found in offices. Each piece of information is stored in only one place. This approach saves storage space by eliminating duplication of data. It makes updating of information faster and more accurate as changes can be made in only one place (table) in the database.

2.4.1 Structure Of Microsoft Access

MS Access provides a variety of objects that can be used together to display and manage information as a powerful productivity tool. These objects are tables, queries, reports, macros and modules. These objects can be selected and manipulated as a unit. A table is a collection of a data about a particular subject. The data in a table is presented in columns (fields) and rows (records). All data in a table describes the subject of the table.

Query is a question about the data in the database. The data that answers or relates to the question can be from a single or several tables. Query therefore is the object used in processing all data stored in separate tables in the database into information for the user. Microsoft Corporation (1997)[9].

Forms and Reports are the objects used for the presentation of the data stored in tables or processed by the query objects. MS Access uses these objects to present a tabular arrangement of data in a convenient way for viewing or printing many records at the same time. A form is often the most convenient layout on screen for data entry, modifying and viewing (displaying) records in the database. While a report is the object used to present data on a printed page using custom (User) layout.

Macros and Modules are objects in MS Access that can be used to combine other objects in a database into a powerful data management system. A macro is an object that records list of actions required from MS Access. It is used to automate basic actions together with other objects to work without programming. Module is an object that contains MS Access and MSVB procedures. This object is required in more complex automated processing than what macros can provide.
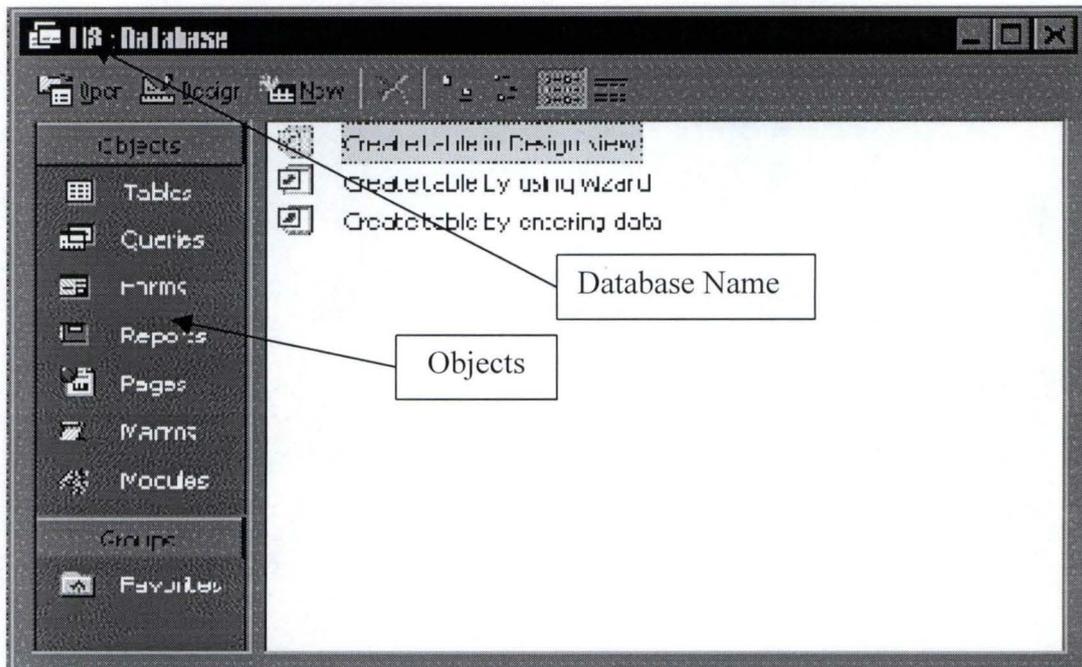
Figure 2.4 <u>MS ACCESS USER INTERFACE</u>

2.4.2 Microsoft Access System Requirement

MS Access version 7.0 requires the following set-up and configuration to function:

a)   An IBM compatible personal computer with 80486 processor or higher;

b)   A hard disk with 50MB of free space;

c)   Mouse or other compatible pointing device;

d)   An Enhanced Graphic Adapter (EGA), Video Graphic Adapter (VGA) or any compatible display;

e)   8 MB of RAM or higher;

f)   Microsoft Windows 95 or later.

2.4.3 Starting & Quitting MS Access

Starting MS Access is similar to starting any Windows 95 or later application program. The procedure is as follows:

i)   Click on start at the start bar located at the bottom left corner of the screen when the system is up and running;

ii)   Point on programs;

iii)   Click on Microsoft Access with the key icon and wait for program to load. This loads up the database dialog windows, which contains options to open or create database;

iv)   To Quit MS Access is as simple as just clicking on the close icon marked X at the top right corner of the window on the screen.

2.4.4 Microsoft Access Specifications

This specification is important during design time for the LIS application, which involves the use of three major software packages. The specification includes the provisions made for the objects applicable in the package. Please refer to Table 2.1 below.

ITEM	MAX. PROVISION
Database file size	1GB
Number of Objects in DB	32,768
No of characters in object name	64
No of characters password	14
No of characters user group name	20
No of concurrent users	255
No of characters in table name	64
No of characters in field name	64
Table size	1 GB
No of characters in text field	255
No of characters memo field	65,535
Size of an OLE object field	1GB
No of tables in query	32
No of field in a Recordset	255
Recordset size	1GB

Table 2.1 **MS ACCESS SPECIFICATION**
(Source: MS Access 97, Online Help)

2.5 AutoCAD Computer Package

Automatic Computer Aided Design (AutoCAD) is a graphic design and drafting tool developed by AutoDesk Incorporation, U.S.A. It is a 2 - and 3 - Dimensional (2D &

3D) design software employing the use of geometric features and configuration. This software, which is developed for use in all design and drafting problems, is recognised as the most widely used PC - based design platform comparable to other CAD programs internationally AutoDesk Corporation (1997) [2]. Its popularity is as a result of its availability, flexibility and simplicity.

The basic AutoCAD package has a capability called surface modeling which makes it a design tool for most disciplines. Miller (1991)[10].

To be able to use this much talked - about and elaborate computer program efficiently, however, it is mandatory that the user be trained or be proficient in both manual and computer drafting principles and techniques.

2.5.1   Basic Concept Of AutoCAD

The most basic concept in computer drafting is the relationship between the screen, database, scale, plot scale, the actual true size of the object and the presentation of the drawing in layers. A drawing in AutoCAD is an electronic entity that is consists of data. All inputs and drawing instructions or commands reside in the computer memory as database that is being manipulated and displayed to the user by the AutoCAD program.

Scale is the relationship between drawing size and the true size of an object. The computer screen is a display of the data and has the capability of displaying widths of a few microns or several miles or kilometres. This versatility has made it possible for objects to be drawn at true size. The difference in size between drawing and physical object may exist only during printing or plotting, due to the limitation in paper sizes. Miller (1991)[10].

Graphical objects in AutoCAD are the visible entities (lines, circles, Polygons, raster images, etc.) that make up the drawing. Each AutoCAD graphical object has methods that allow an application to perform most of the AutoCAD editing commands, such as copy, move, erase, etc. They also have methods for setting and retrieving extended data, highlighting and updating, etc.

Non-graphical objects are the invisible informational elements that are part of the drawing. These include layers, line types, selection sets, etc. Each non-graphical object has methods and properties specific to its purpose. And they have methods for setting and retrieving extended data.

The drawing editor consists of the screen cursor, which is made up of two lines, one horizontal and the other vertical. Their intersection is referred to as the screen cursor location. Control of the movement of the screen cursor is achieved through the use of the cursor keys on the keyboard or the pointing device such as mouse or the digitizer pad. The mouse, however, is the main device used in this program. Use of AutoCAD therefore is almost impossible without pointing devices. Miller (1991)[10].

Layers are transparent overlays containing group of associated components or objects in a drawing (AutoCAD). The user can globally control their visibility, colour, ability to be edited and their line type. AutoCAD permits the use of as many layers as may be required in a drawing.

File Numbers
(Green)

Beacons (Blue)

Plot Layout (Red)

Base Map (Black)
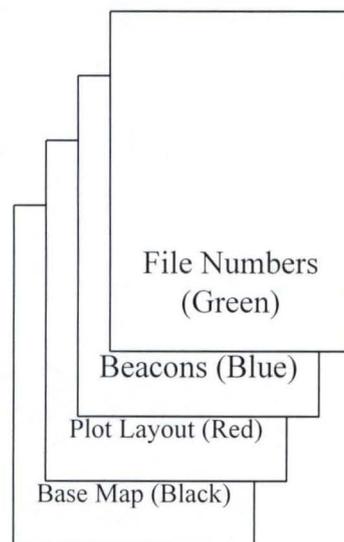
Figure 2.5- <u>AutoCAD LAYERS</u>

AutoCAD has 4 different user interfaces or techniques by which the user communicates with the computer. These are commands through **Toolbars, Pull-down**

menus, the **Keyboard** at the command line and digitizer **Tablet** menu pad, if available.

AutoCAD communicates to the user through **Title bar** where the current drawing name is displayed; through **Object properties** showing current layer, colour and line type. The **User Coordinate System** (UCS) icon at the lower left corner of the screen serves to show direction of X - and Y - axis of the screen. The **Status bar** showing help text, system settings or modes such as Coordinate Display, Grid Display, Ortho as well as Time. (see figure 2.6)
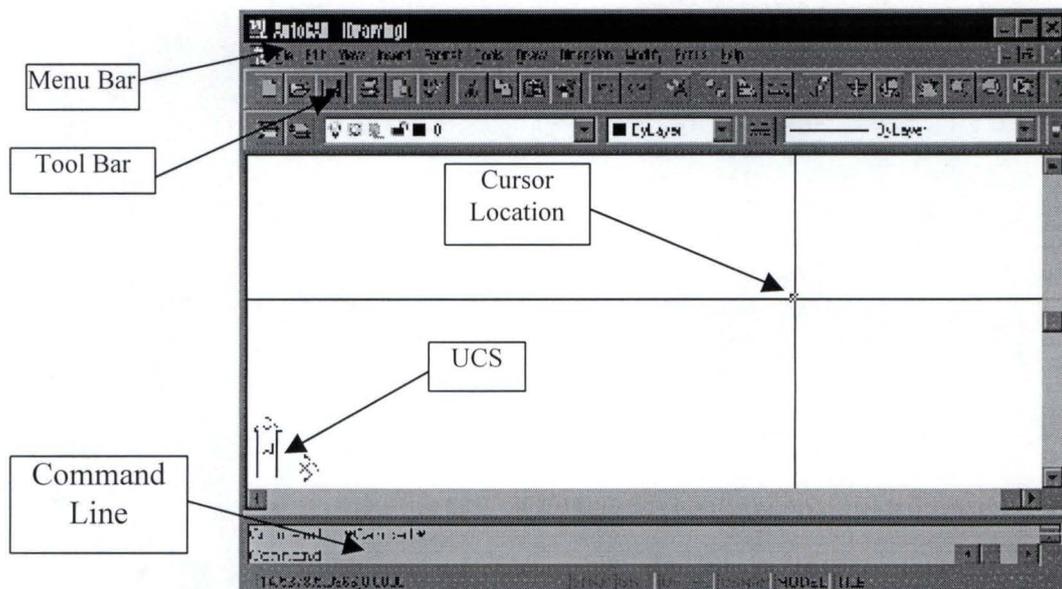
Figure 2.6 AutoCAD DRAWING EDITOR

2.5.2 AutoCAD Main Features

The built-in features of AutoCAD are numerous as this is a tool that can be used in virtually all graphic designs and graphic related information. The features worth mentioning in this project are:

a. The operability on Windows 95 and later computer operating systems;

b. The ability to display and print / plot geometric objects at any scale or size;

c. The ability to link drawing objects to external databases;

d. The ability to use Structured Query language (SQL) to access data stored in

different DBMS so as to link records to objects in drawing. Autodesk (1997)[2];

e.   The ability to translate data processed and stored as text file by other programs into drawing objects;

f.   The ability to process and store graphic information in transparent overlays or layers;

g.   The incorporation of ActiveX automation for customization and windows compatibility making programs development in Microsoft Visual Basic compatible with AutoCAD. Autodesk (1997)[2].

2.5.3 Starting & Quitting AutoCAD

AutoCAD for windows 95 and later can be started just as any other application program could. When the computer is up and running, the procedure to start or load AutoCAD drawing editor include clicking on the start bar at the bottom left corner of the screen, pointing to programs item at the pop-up menu and click on AutoCAD icon or folder at the fly out menu. While at the drawing editor, new drawing can began and old or existing drawing can be called up to the screen through the use of any of the 4 command interfaces mentioned earlier.

Similarly, Printing / Plotting, Saving and Quitting AutoCAD session can be achieved through any of the 4 commands- Command-line, Toolbar, File menu or Digitizer pad menu (when available).

2.5.4 AutoCAD System Requirement

This includes computer system capacity, configuration and performance appropriate for AutoCAD operations. Being a graphic manipulation program, it requires high memory allocation for ease of operation. The entry RAM level for most versions of AutoCAD is 8MB. But Release 14 requires not less than 32MB of RAM to operate in addition to the following Software and Hardware requirements:

i)   80486 or Pentium (Intel) processor, its equivalent or higher processor;

ii)   VGA or Super VGA monitor for its display;

iii)   Microsoft windows 95 or later;

iv)   Large hard disk space of about 150 MB for program files storage;

v)   Mouse or any pointing device for graphic applications;

vi)   Data backups facility like write-able CD drive, Zip drive or tape drive;

vii)   Large drum or flatbed plotter of size about A0 for large drawings and map output;

viii)   Large drum or flatbed scanner of about A0 size for raster image capturing;

ix)   Large digitizing set - table and tablet for vector data capture.

2.5.5. AutoCAD Specifications

This is the limitation of AutoCAD in terms of maximum drawing size file naming system and other pros and cons, available as industry standards. Also how is the program AutoCAD recognised by non-user. AutoCAD R14 has the following limitations and standards:

a .   Minimum RAM size   -   32MB;

b.   Minimum Swap file size   -   64MB;

c.   Drawing file extension   -   .DWG;

d.   Maximum drawing file size is governed by the size of the swap file;

e   Script file containing text with AutoCAD executable commands have the extension '.SCR'.

AutoCAD, as an Autodesk product, has the Autodesk logo as its symbol of recognition and that is as in the figure below.

Figure 2.7 <u>AUTODESK LOGO</u>

Autodesk

2.6 Visual Basic Programming Package

Visual Basic (VB) is an object-based programming language for Microsoft windows application development. The visual part refers to the method used to create the graphical user interface (GUI). Rather than writing numerous lines of code to describe the appearance and location of interface elements, pre-built objects can simply be dragged and drop into place on screen using screen pointing device.

The Basic part refers to the BASIC language, a language that is used by more programmers than any other language in the history of computing. The VB has evolved from the original BASIC language and now has several hundred statements, functions and keywords, which relates directly to the windows GUI. Microsoft Corporation (1997)[8].

As with many modern programming languages, VB supports a number of common programming constructs and language elements. The subtle differences can be found only in the event-driven nature of VB, where user interaction is required through the use of mouse or keyboard.

The working environment in VB is often referred to as the Integrated Development Environment (IDE), because it integrates many different functions, such as design, editing, compiling and debugging within a common environment. This is against the traditional application development process, which is broken down into 3 distinct steps - writing, compiling and code testing, at different environments.

Visual Basic provides for a great deal of flexibility, allowing for configuring the working environment to best suit individual styles. Flexibility and the interactive nature of VB simplify application development processes, making it possible to test the effect of codes during editing rather than waiting to compile later.

The VB programming language is not unique to Microsoft Visual Basic. It is available as Visual Basic Application (VBA) edition in Microsoft Excel, Microsoft Access,

AutoCAD and many other windows applications, thus making it a very versatile and reliable programming language, hence its choice in this project.

2.6.1 Visual Basic Programming Concept

To understand the key concepts upon which VB is built, it is helpful to know how windows work. A simplified version of the workings of windows involves the concept of windows itself, events and messages. Windows is defined as a rectangular region with its boundaries. The Microsoft windows operating system manages all opened windows by assigning each one a unique identity number or window handle.

The system continuously monitors each of these windows for signs of activity or events. An event can occur through user actions from keyboard or mouse click, etc. Each time an event occur, it causes a message to be sent to the operating system (OS). The OS then process and broadcast the message to the other windows for various appropriate actions. VB is designed to handle many of these messages automatically enabling the programmer to concentrate on only few events for convenience, thereby making quick and powerful application development without having to deal with unnecessary details

Visual Basic is an object based programming language. An object in VB is a combination of code and data that can be treated as a unit. Such units as Controls in a Form (command buttons), Form, Database or Charts from MS Excel. VB objects supports properties, methods and events. An object properties or data constitute the settings or attributes that govern the appearance of that object, while the method are the various procedures that can operate on the object. An event on the other hand, is an action recognised by an object, such as clicking a mouse or pressing a key that can respond to codes written by the programmer. Generally, methods are actions to be performed, while properties are the attribute setting for objects in VB

Because a VB application is based on objects, the structure of its code closely models its physical representation on screen. The Form that is displayed on screen is a representation of the properties that define its appearance and intrinsic behaviour. For

each Form in an application, VB automatically generates a related form module with file extension '.FRM' that contains its code.

Code that is not related to any specific Form or Control can be placed in a different type of module called standard module with file extension '.BAS'. A procedure that might be used in response to event in several different objects is placed in a standard module rather than repeating or duplicating the code in the event procedures for each object.

Form are the basic building blocks of a visual Basic application, it is the actual windows with which users interact with the computer when they run the application. Forms and Controls are used, their properties are set, and the code for their events is written at design time, which is the time of building an application in the VB environment. Microsoft Corporation (1997)[8].

2.6.2 Features Of Visual Basic

In addition to the availability of Visual Basic Application (VBA) edition in most windows-based applications, Visual Basic has the following outstanding features that make it an up-to-date or up-to-task programming language:

i)   Data Access;

ii)   ActiveX technology;

iii)   Internet Access capability;

iv)   Standard executable (.EXE) application.

With Data Access features, databases can be created and front-end applications can be developed with VB for most popular database formats, including Microsoft SQL server and other enterprise level database.

ActiveX technology allows the use of the functionality provided by other windows-based applications. VB application can also be made to access documents and

programs across the Internet. Finished applications can freely be distributed on a true '.EXE' file that uses a run-time Dynamic Link Library (.DLL).

The ability to share data between objects is one of the key features of Microsoft windows operating system. Visual Basic offers greater flexibility in how to communicate with other applications and manipulate their objects from a given VB application. Microsoft Corporation (1997)[8].

2.6.3   Visual Basic User Interface

The VB Integrated Development Environment (IDE) consists of the following user interface elements:

> Menu bar, context menu, Toolbars, Toolbox, Project explorer window, Properties window, Object browser, Form designer, Code Editor Window, Form Layout window and immediate, local and Watch windows.

The Menu bar contains the commands required to work with VB. These commands include menus to access functions for specific programming element such as Project, File, Format, Run, Debug, etc.

Context menu contains short cut to frequently performed actions accessible through clicking the right mouse button on the particular object.

Toolbars provides quick access to commonly used commands in the programming environment. A button on the toolbar is clicked once to carry out the action represented by that button.

Toolbox provides a set of tools that are used at design time to place Controls on a Form. Projects explorer window lists the forms and modules in the current project. A project in this context is the collection of files used to build an application.

Properties window lists the property settings for the active Form or Control. A property is a characteristic (Size, Caption, Colour, etc.) of an object.

Object Browser lists objects available for use in a project, providing a quick way to navigate through code. Thus Object Browser is used to explore objects in VB and other applications, to see what methods and properties are available for those objects, so that code procedures can be cut, copy and pasted into an application.

Form Designer serves as a window for designing the interface of an application. This is done by adding controls, graphics and pictures to a form to create the desired appearance. Each Form in the project has its own Form designer window.

Code Editor Window serves as an editor for entering application code. A separate code editor window is created for each form or code module in the application. Form Layout Window allows for positioning the form in the application using a small representation of the screen.

Immediate, Locals and Watch Windows provided for use in debugging the application. They are available only when running application within the IDE at design time.
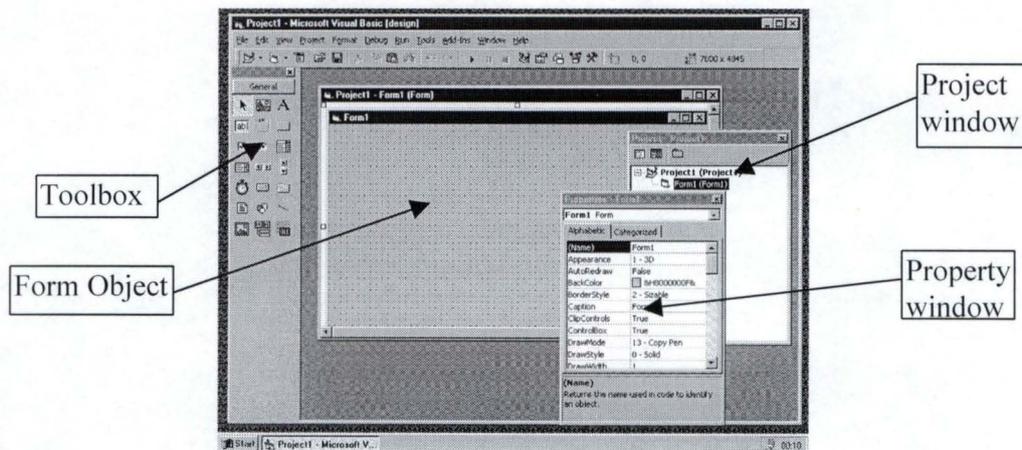

Figure 2.8 VISUAL BASIC USER INTERFACE

2.6.4 Visual Basic Data Accessibility

Microsoft Visual Basic is provided with data access tools to create and use structured database systems to manage the applications' data. Using Data Access Object (DAO), it is possible to create databases and build full-featured applications that access

existing databases in many formats. This possibility offers many programming advantages like enabling writing applications that share data with other programs, and thus simplifying programming procedures.

VB provides data access capability based on the Microsoft Database Engine, the same database engine that powers Microsoft Access. The jet engine handles the mechanics of storing, retrieving and updating data and provides the powerful DAO oriented programming interface.

There are 2 methods of VB interfacing with the MS jet database engine - Data control and Data Access Objects. While the Data Control gives limited ability to access existing databases without programming, the DAO model is a complete programming interface that makes total control of the database possible.

The DAO model is a collection of object classes that models the structure of a relational database system. These classes provide properties and methods that can be used to accomplish all of the operations necessary to manage such systems, including facilities for creating data bases, defining tables, field and indexes, establishing relationship between tables navigating and querying the database, etc.

Data base programming in VB consists of creating data access objects such as Database, TableDef, Field, and Index Objects that correspond to the various parts of the physical database to be accessed. Properties and methods of these objects are employed to perform operation on a database. VB Forms can be used to display result of operations and accept input from user using both bound and unbound controls.

Categories of databases recognised by VB through DAO include Visual Basic Databases or native databases having the same format with MS Access. Providing maximum flexibility and speed of manipulation. Others are external databases with different format from MS Access and Opened Data Base Connectivity (ODBC) database like SQL Server.

2.6.5 Visual Basic & Structured Query Language

Structured Query language (SQL) is a database programming language with origin closely connected to the invention of the Relational Database by E .F. Codd in the early 1970s. Microsoft Corporation (1997)[8].

Modern SQL has evolved into widely used standards for Relational Databases, defined in the American National Standard Institute (ANSI) standard, and used by the Microsoft Jet Database Engine. Thus SQL has advantage over other database programming languages, as it is an industry standard database interface.

SQL commands allow access and manipulation of a wide variety of database products from many different vendors. Because SQL is purely a Relational Database language, the terms Row and Column are most frequently used to describe the operations of the SQL commands. Microsoft Corporation (1997)[8].

The SQL is composed of commands, clauses, operators and aggregate functions. These elements are combined into statement used to create, update and manipulate databases. SQL provides both Data Definition Language (DDL) and Data Manipulation Language (DML) commands. DDL commands allow the creation and definition of new databases, fields and indexes while DML commands allows creation of queries to sort, filter and extract data from the database.

SQL is used to create QueryDef objects as the source argument to the OpenRecordSet method, and as the RecordSource property of the data control. It is also used with 'Execute' method to directly create and manipulates Jet Databases and to create PassThrough queries to manipulate remote Client Server databases in VB application.

In VB program, it is possible to create a 'SELECT' statement in an application by concatenating local variables into statement as needed, to select, sort or filter the data as dictated by the application.

2.6.6 Visual Basic Application Structure

The way Visual Basic application is structured can make a difference in its performance as well as in the maintainability and usability of the code. The code in VB application is organised in a hierarchical order, typical application consists of one or more modules – a Form module for each Form in the application, optional standard modules for shared code and optional class modules. Each module contains one or more procedures that can contain the code – event procedures, Sub or Function procedures and property procedures.

Because VB is based on objects, it is helpful to think of the application in terms of the objects that it represents. That is, the Forms and the Controls within the Forms.

2.6.7 Visual Basic System Requirement

Hardware and Software system requirement for Visual Basic installation include:

i)   Microsoft Windows 95 or later operating system (O.S.);

ii)   80486 or higher micro-processor;

iii)   Hard Disk Drive with minimum of 50MB available space for full installation;

iv)   CDROM Drive;

v)   VGA or higher resolution screen;

vi)   Minimum of 8MB of RAM;

vii)   A mouse or any other pointing device.

2.6.8 Visual Basic Specification/Limitations

A single Visual Basic project or application can contain up to 32,000 identifiers, such as Forms, Modules, Variables, Constants, Procedures, Functions and Objects.

Variable names length can be up to 255 characters. While Forms, Controls, Modules and Classes names can be up to 40 characters long. No limitations on the actual number of objects in a project or application.

Number of Controls allowed on a single Form depends on the type of Controls used and the available system resources. A maximum of 254 particular Control is allowed per any single Form. Maximum number of code lines per standard Module, Form or Class is 65,534.

A single line of code consists of up to 1023 bytes. Maximum size of code per procedure is 64KB. File types include Design-time, Run-time and miscellaneous development files. Design time files extensions include:

a)   .vbp   -   Visual Basic Project;

b)   .frm   -   Visual Basic Form;

c)   .Bas   -   BASIC Module;

d)   .cls   -   Class Module.

Run time files extensions include:

a)   .dll   -   Dynamic Linked Library;

b)   .exe   -   Executable files;

c)   .ocx   -   ActiveX Control files;

d)   .vbb   -   ActiveX document bootstrap files;

e)   .vbd   -   ActiveX document state files.

CHAPTER THREE

LAND INFORMATION SYSTEM ANALYSIS AND DESIGN

3.1 Introduction

Analysis of a system involves studying the procedural components that make up the existing system with a view to discover its basic problems or needs for improvement. Badamusi (2000)[4]. These procedural components for Land Information System (LIS) are the methods of land data collection and capture, the methods of land data storage and processing, and the methods/mode of information retrieval and presentation to users.

Types of data for analysis in LIS include not only the parcel-based land information such as plot size and its definition processes, plot ownership registration processes, land use and plot development status, etc. but also utilities (telephone, electricity and water) and underground services (pipelines) that are available to the plot. Dale and McLaughlin (1988)[5].

All data input or capture and the procedural strategies is controlled by the requirement for the mode of information dissemination. That is, the output is considered in the mode of data input and processing necessary to produce a comprehensive requirement specification for the system. In LIS, the output is 'Information' on parcels of land - the land identity, its shape, size, location, ownership, purpose and what is on it, etc.

3.2 The Existing System

The department of Land, Planning and Survey, FCDA has, as its main function, the responsibility to provide land for various purposes to various interest groups and individuals for the development of the new Federal Capital Territory. Spaces of land earmarked in the Master Plan for Abuja for residential, commercial, religious and other purposes have to be made available to all interested government agencies, corporate organisations and individuals from the general public for physical development.

This function is being carried out based on laid down policies and procedures under the Nigerian Land use Act No. 6 of 1978. This involve Registration of Land Applicants, Surveying, Plot Subdivision, Plot Allocation, Plot Ownership registration, processing of Certificates of Occupancy, land Revenue Collection, Building Plan Approval / Building Permission as well as Plot development Monitoring.

Summary of the Existing System

i)   Provision of list of private applicants per state of origin and list of corporate applicants;

ii)   Provision of list of plots or parcels of land and their definitions per cadastral zone or district;

iii)   Provision of approved list of allocation of plots of land to applicants;

iv)   Provision of cadastral survey data for all plots of land in a zone or district;

v)   Provision of ownership record for each allocated plot of land in a district;

vi)   Production of Title Deeds Plans for all allocated plots;

vii)   Preparation of Certificates of Occupancy for all allocated plots;

viii)   Registration and Issuing of Signed Certificates of Occupancy;

ix)   Provision of Base Maps for all planning purposes in the FCT;

x)   Revenue collection from all land Applicants / Developers;

xi)   Provision of Building Permissions for all developers;

xii)   Maintenance of all plots development Monitoring record.

3.3   Analysis Of The Existing System

Land Information System (LIS) as practiced in the department of Land, Planning and Survey, FCDA, is developed and maintained on divisional, sectional and unit basis. All the records or media of information in the various processing points are available only on file folders and or hard cover registers. These, not only tend to be voluminous and room space conscious but also are subject to the processes of wear and tear due to usage.

3.3.1   Plot Allocation

The process of plot allocation (Plot-Applicant matching) is carried out manually using list of available plots against file-folder-numbers of applicants. Due to fatigue and pressure, officers occasionally recommend one plot to two or more applicants at different times.

This normally results in clashes of interests on the said plot for would-be developers. And as such the manual process generates lots of controversy and loss of confidence in the whole system.

3.3.2   Data Processing

Land information processing, though relatively different at the various locations has some overlapping procedures. For instance ownership detail or registration is not expected to be different at the cadastre and C of O positions from what is obtainable in the approved list of allocations in the files registers.

These ownership records are a mere duplication of the allocation process. This renders ownership records redundant especially when transaction occurs and registered in Deeds, ownership records in the cadastre remain unchanged.

3.3.3   Data Storage

Problem in data maintenance and storage is a threat to the system considering the volume of data processed daily from inception to date. From sources in the land registry, as at 30/05/2000, 75,579 land applicants' files were opened. And at Deeds registry over 13,033 certificates of occupancy were issued for the same period.

Presently, the file registry alone has occupied two large rooms with only file folders and several volumes of hard cover registers containing details of land applicants. These file folders are those that are waiting for plot allocation processing.

Deeds and Cadastral (Cartography) records offices have similar and equal volumes of file folders stacked up in rooms. Topographic maps (Base Maps), Cadastral maps and layout plans for all the planned districts and zones have similar storage problems.

For lack of room space, metal container cabins are being used for storage of maps in locations outside the office building. All these storage have been built up in a period of 20 years (1980 - date). At the moment the demand for land processes is even more and requiring more metal container cabins and spaces to keep them.

3.3.4   Cost Of Data Processing

High cost of land processing in this setup can never be overemphasized. Owing to the fact that FCT, as the centre and home for all Nigerians, is just coming up. The demand for land information and land acquisition is very high. This results in lots of pressure on the operating staff, coupled with the storage problem stated above.

For example, to conduct a search (any transaction?) on a particular C of O requires about two days to complete. As this has to be done through the file folders stacked in more than one room. Similarly authentication of plot ownership requires checking in the Intelligent Sheet (in Cartography) as well as in the file folders and film (original) copy of the TDP.

So at any point that particular land information is required, a lot of man-hours are wasted for both the operating staff, the management and the user of the information, resulting in high cost for such information, which at the end may not be available or may be inaccurate.

3.3.5   Information Retrieval

As already stated, land information is located in bits in all the functional units of the department. These bits of information are kept either in paper forms inside file folders or arranged in tabular format in hard cover registers.

Due to the number of data available or already treated, the file folders and registers are normally in many volumes. And as a result of daily usage, older volumes of these

paper storage media are mutilated, sometimes with some pages completely torn off. Bringing about total loss of vital information. Loss of information can also results in misplacement of document folder sometimes inside another folder during file movements.

3.3.6 Information Distortion

Maintenance of bits of land information stored in different locations under various officers ensures distribution of professional functions and participation in land information processing. The major disadvantage is that once there is a problem in the system, control is always difficult, as the source of the problem will not be easy to locate.

Desk officers can easily distort information through some act of omission or commission. This is possible as information is processed manually and sometimes under pressure from both management and the general public. Once information is distorted on a particular parcel of land, it will be difficult to dictate at a good time. This often leads to confusion and misinformation.

3.3.7 The Alternative System

A computerised land information system employing the use of comprehensive database management over a Local Area Network (LAN) will improve the system.

Requirement for storage of volumes of paper documents will be minimized. Data duplication will be eliminated. Information sources will be centralized and easily managed, and data integrity will be ensured as well as reduction in cost of data processing. Clerical operation will be reduced to filling of paper forms with data relevant to computer application programs only.

3.4 The LIS Database Design

It is important to note that effective and efficient computerised information system cannot be achieved without the effective application of database management system,

which involve the use of facts about different subjects arranged and stored in separate tables.

Reliable database design in this context signifies reliable LIS application development. Separate database files therefore has to be created for all land subdivisions (layouts) to contain data (facts) about each subdivided parcel of land.

Four database files are created for this project and are structured into two main categories - constant and variable. The constant databases, which are designed not to be layout dependent, are:

i)   LANDAPP.MDB;

ii)   LANDREV.MDB;

iii)   MAPS.MDB.

LANDAPP.MDB consist of two tables, one for private applicants and other for corporate land applicants. LANDREV.MDB also has two tables. One for Revenue collection and the other for land Revenue subheads. The MAPS.MDB database file has four tables - Survey Controls, Base Maps, Cadastral Maps and Aerial Photographs.

The variable database which have their names varied according to layout is based on LIS.MDB structure which is consists of thirteen tables each containing facts about the subdivided parcel of land. The table and their field definition are copied at run-time from LIS.MDB database file. All the four databases are created at design time using MS Access.

AutoCAD drawings for various databases or layouts are produced using a program for survey data generation developed by me and is being used in the case study.

Queries are constructed using Visual Basic Codes with Data Access Object (DAO) and Structured Query language (SQL) facility. Tables of variable databases will have their

records linked with AutoCAD objects (polygons or plot number) and programmed with Visual Basic to obtain event-driven query interaction with user through menus.

3.4.1 TABLES

DATABASE NAME:- LANDAPP. MDB

S/NO	TABLE NAME	DESCRIPTION	FIELDS	KEY	TYPE	SIZE
1	APPRES	Private Resid. land Applic's	13	REFNO	TEXT	10
2	APPCORP	Corporate Land Applicants	11	RFNO	TEXT	10

DATABASE NAME:- LANDREV.MDB

S/NO	TABLE NAME	DESCRIPTION	FIELDS	KEY	TYPE	SIZE
1	REVENUE	Land Revenue Collection	4	REFNO	TEXT	10
2	REVSH	Land Revenue Subheads	3	SHNO	TEXT	10

DATABASE NAME:- MAPS.MDB

S/NO	TABLE NAME	DESCRIPTION	FIELDS	KEY	TYPE	SIZE
1	SCONTROL	Survey Controls	6	CONTNO	TEXT	8
2	BMAPS	Basemaps	8	BMAPSNO	TEXT	6
3	CMAPS	Cadastral Maps	6	CMAPNO	TEXT	12
4	AERIAL	Aerial photos	10	PHOTONO	TEXT	4

DATABASE NAME:- LIS.MDB

S/NO	TABLE NAME	DESCRIPTION	FIELDS	KEY	TYPE	SIZE
1	LAYOUT	Layout Details	8	LAYCODE	TEXT	5
2	PLOT	Plot Details	15	PLOYNO	IN	3
3	BEACON	Property Beacon	3	PBNO	IN	5
4	PLOTBEACON	Plot-beacon relation	2	SNO	AUTO	-
5	TDP	Title Deeds Plan	5	TDPNO	TEXT	10
6	C of O	Certificates of Occup.	7	CREGNO	TEXT	15
7	BPAPPR	Building Plan Approv.	5	BPANO	TEXT	10
8	DEVSTAT	Development Status	5	DSTATNO	TEXT	10
9	ASTRANS	Assignment Traction	8	ASNO	TEXT	10
10	PATRANS	Power of Attorney	7	PANO	TEXT	10
11	MTRANS	Mortgage Transaction	8	MGNO	TEXT	10
12	SUBLEASE	Sublease Transaction	9	SLNO	TEXT	10
13	GTRANS	Gift Transaction	7	GTNO	TEXT	10
14	ALLOCATION	Make table from plot/Applicant Matching	7	PLOTNO/ REFNO	TEXT	10

3.4.2. FIELDS

DATABASE NAME: LANDAPP.MDB

TABLE NAME: APPRESS

S/NO	FIELD NAME	DESCRIPTION	TYPE	SIZE	REQUIRED	INDEX
1	REFNO	Reference number	TEXT	7	Y	Y
2	SURNAME	Surname	TEXT	10	Y	N
3	ONAMES	Other names	TEXT	15	Y	N
4	ADDRESS	Applicant Address	TEXT	25	N	N
5	TELEPHONE	Telephone No	TEXT	11	N	N
6	STATE	State of Origin	TEXT	15	Y	N
7	LGA	LGA.of Origin	TEXT	15	N	N
8	AGE	Age of Applicant	INT	2	Y	N
9	APPDATE	Date of Application	DATE	10	Y	N
10	NKIN	Next of Kin	TEXT	15	N	N
11	NK ADD	Next of Kin Address	TEXT	25	N	N
12	TELEPHONE NO	Telephone number	TEXT	11	N	N
13	TCLR	Tax Clearance	TEXT	1	N	N
14	BCERT	Copy of Birth Cert	OLE	1	N	N
15	PPORT	Passport	OLE	Pict.	N	N

DATABASE NAME: LANDREV.MDB

TABLE NAME: REVENUE

S/NO	FIELDNAME	DESCRIPTION	TYPE	SIZE	REQUIRED	INDEX
1	REFNO	File Number	TEXT	10	Y	N
2	SHNO	Rev. Subhead Number	TEXT	10	Y	N
3	AMNT	Amount Paid	C	9,2	Y	N
4	PDATE	Payment date	Date	10	Y	N
5	PAYNO	Payment number	TEXT	10	Y	Y

DATABASE NAME: MAPS.MDB

TABLE NAME: SCONTROL

S/NO	FIELDNAME	DESCRIPTION	TYPE	SIZE	REQUIRED	INDEX
1	CONTNO	Control Number	TEXT	8	Y	Y
2	NORTH	Northing	GN	11,3	Y	N
3	EAST	Eastings	GN	10,3	Y	N
4	HEIGHT	Height in metre	GN	7,2	N	N
5	DESC	Point description	TEXT	25	Y	N
6	CONSULT	Consultant	TEXT	25	Y	N

DATABASE NAME: LIS.MDB

TABLE NAME: LAYOUT

S/NO	FIELDNAME	DESCRIPTION	TYPE	SIZE	REQUIRED	INDEX
1	LAYCODE	Layout Code	TEXT	5	Y	Y
2	LAYNAME	Layout Description	TEXT	25	Y	N
3	PLANNER	Name of Planner i/c	TEXT	15	Y	N
4	CONSULT	Name of Consultant	TEXT	25	Y	N
5	BMAPNO	Base map number	TEXT	12	Y	N
6	ENGDWG	Dwg overlay	OLE	-	N	N
7	DATE	Date Layout approved	DATE	10	Y	N

3.5   Data Collection

Gathering of data and information for this project was achieved direct from the desk officers at the various units of the department. Live data however have been distorted for obvious reasons in these write-ups.

Layout and land parcels information were obtained from the Urban and Regional Planning Division for JABI (B4) planned district. From the Survey Division, Spatial data were collected for some of the plots in JABI (B4) district.

Similarly, a list of 74 private and 20 corporate land applicants were collected from the Land Division. TDP and C of O information were collected from the various units, so also Base Map covering the district in focus (JABI) was collected from the relevant unit of the department.

3.5.1   Files & Data Maintenance

The storage media for files and databases is the Hard disk of Microcomputer and other secondary storage media such as diskettes and CDROMS. In the hard disk, files are organised into directories and/or folders in the following order:

a)   C:\Project\LIS\LANDAPP.MDB;

b)   C:\Project\LIS\LANDREV.MDB;

c)   C:\Project\LIS\MAP.MDB;

d)   C:\Project\LIS\LIS.MDB.

All the database files are to be password protected, such that unauthorized users do not gain access. Users are categorized into Workgroups (Sections/Units) as applicable in the Divisions of the Department.

Data structure is in accordance to the relational data model available to the Microsoft Access. That is, all data are arranged in tables and structured into rows and columns representing various subjects in the database. All records (rows) are unique within the same table and do not permit duplicate entries. All tables are however related together through common fields such as the plot or parcel number field (PLOTNO).

3.5.2   Types Of Queries

Queries are categorized into two for information about parcels of land. These are the Management Support and the generally query types.

The General Query requires answers for:

i)   Date of Building Plan Approval;

ii)   Plot ownership;

iii)   Development Status;

iv)   Plot Identification – No, Size, Use and Location;

v)   C of O collection;

vi)   Name and address of plot owner;

vii)   Survey Data;

viii)   Transactions on plot;

ix)   Date of Ministerial approval for plot allocation.

The Land Management Support System (LMSS) Query requires answers such as;

i)   List of unallocated plots in a given layout;

ii)   Summary of plot allocation per state of origin of allottees;

iii)   Periodic list of land applications per State (with date) awaiting processing;

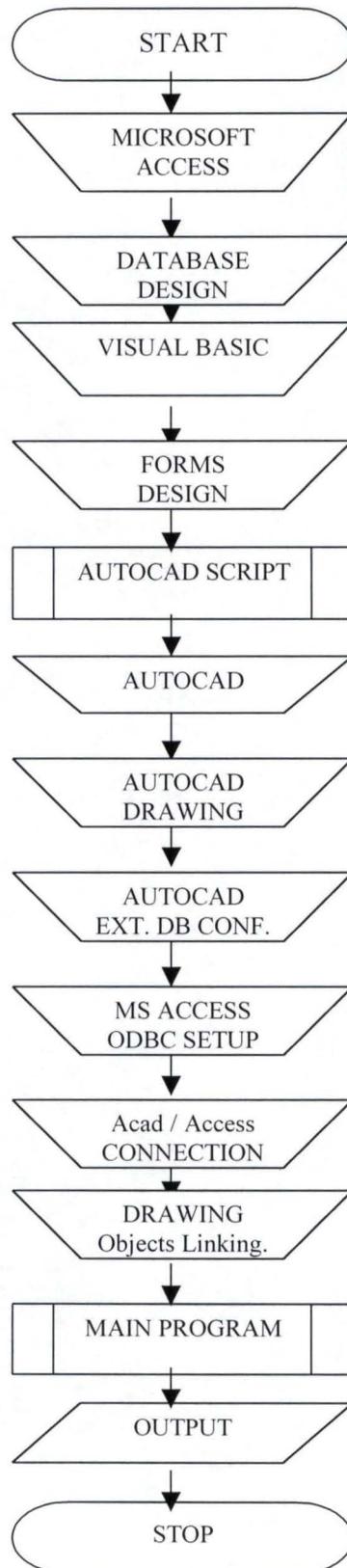iv)   Layout Statistics – No of Plot in Layout, No of Plots/Use, Land coverage by Layout.

3.6   Data Capture Techniques

Data capture in Land Information System involve the use of computer peripheral devices such as Scanners, Digitizers and Keyboard for both graphical and textual data. Digitizers are used to capture graphic data using vector (point to point) format while the scanner is a device that captures data using raster technology or format. That is formation of image using dots or pixels
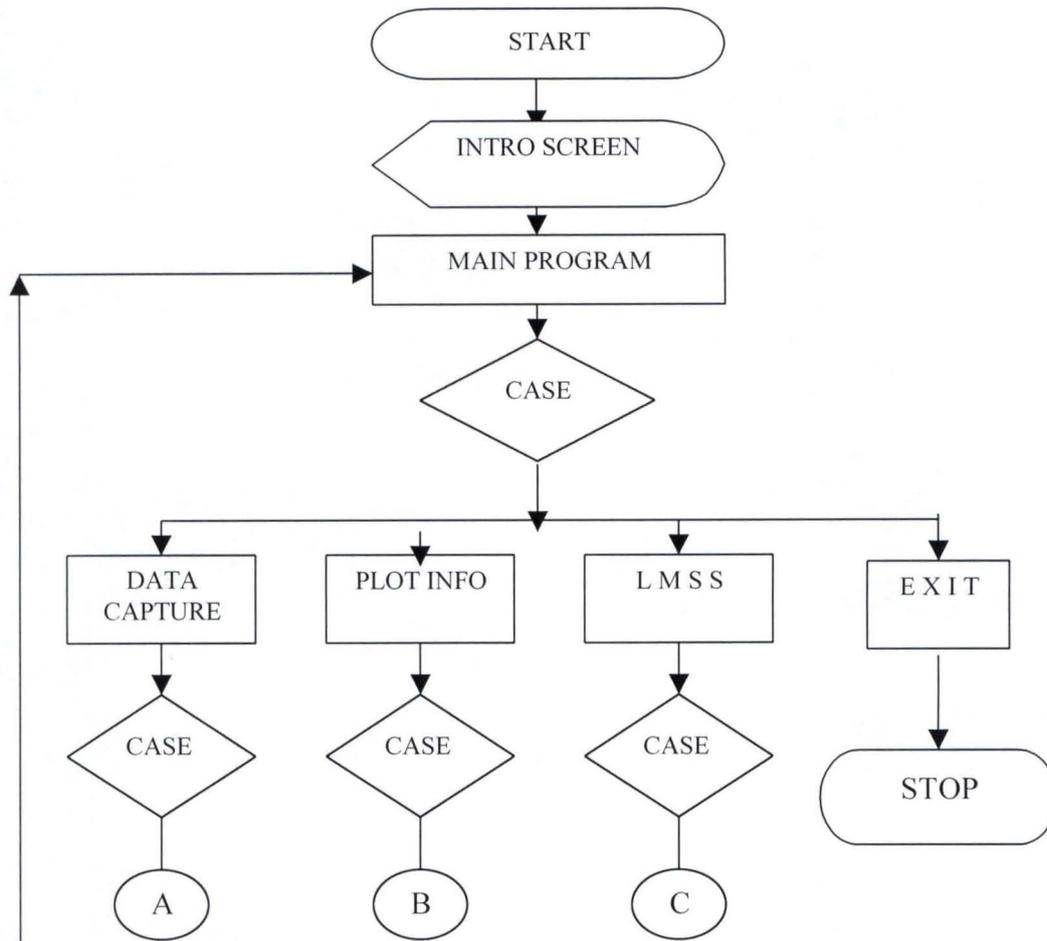
All OLE (Object Linking Embedded) type fields such as copies of TDP, C of O, Birth Certificate and Certificate of Incorporation are to be scanned. Similarly copies of Base Maps and Engineering drawings are to be scanned or digitized into the appropriate layers of the AutoCAD drawings.

Textual data such as lists of Plots, Beacons, TDP, C of O, Applicants, etc. are to be captured through the keyboard. AutoCAD drawings are to be executed through script files generated in text format by another stand-alone program "SURVCOM.BAS" developed by the author of this project.
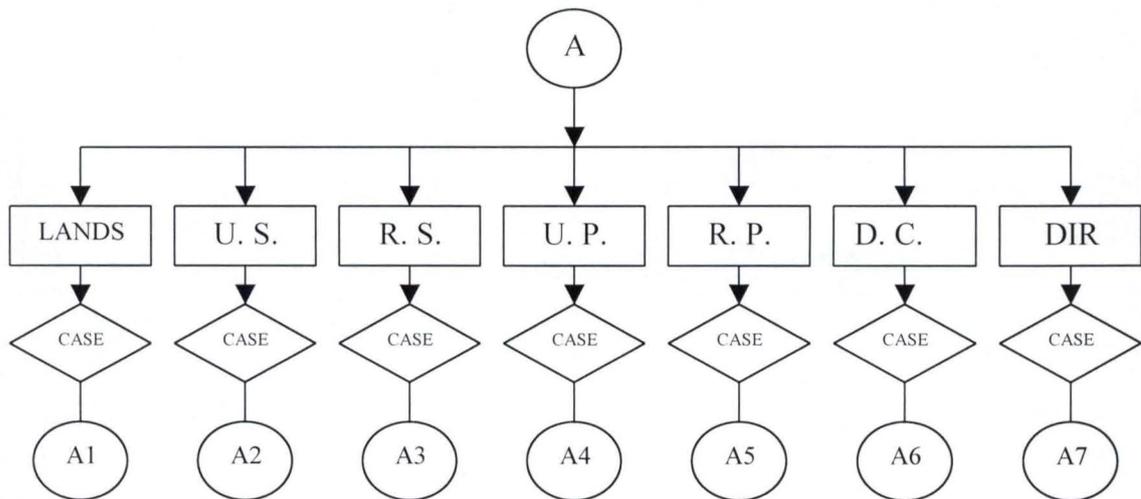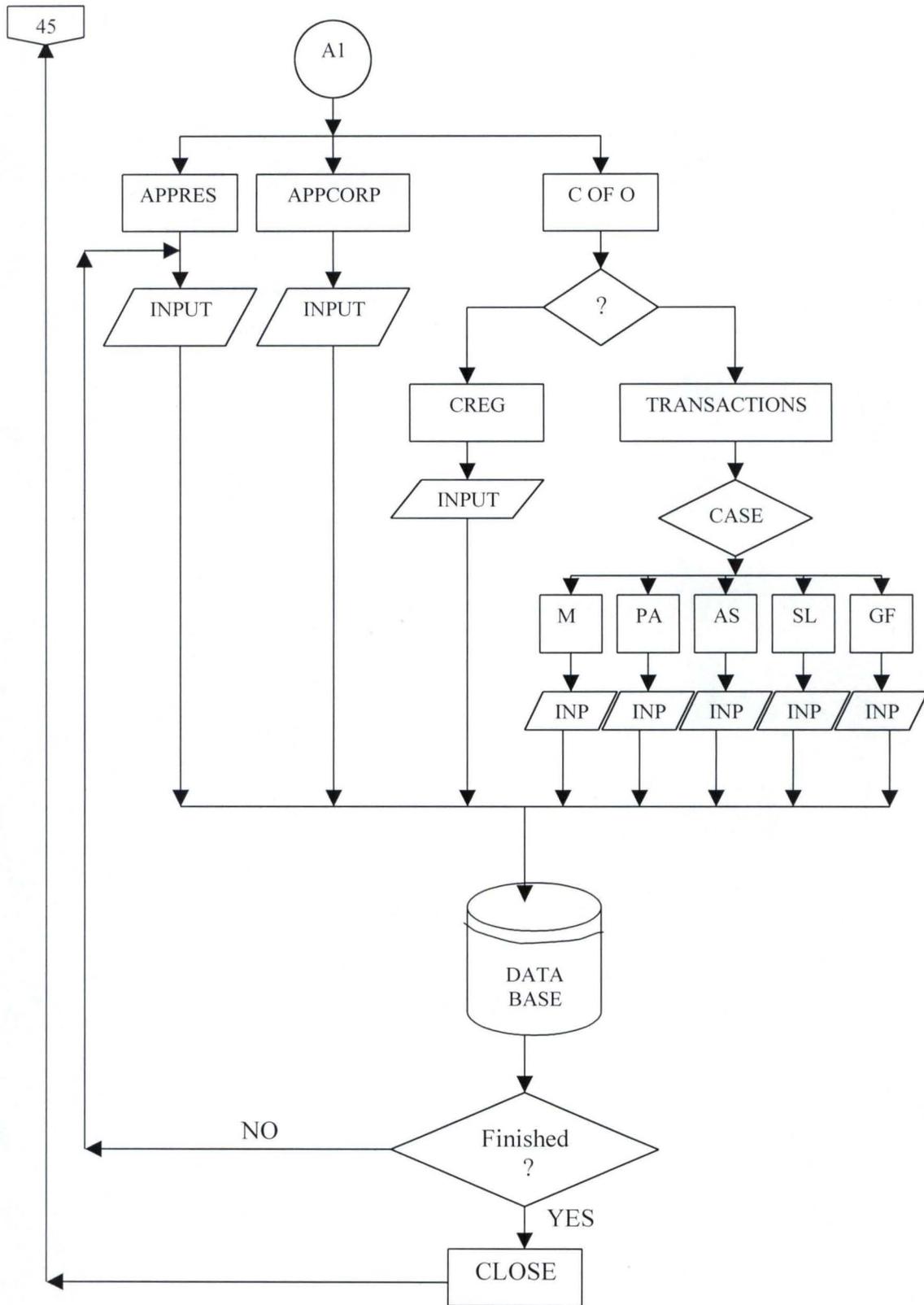
3.7   Program Flow Charts

```
            ┌──────────────────────┐
            (        START          )
            └──────────────────────┘
                       │
                       ▼
            ╱──────────────────────╲
            ╲   MICROSOFT ACCESS    ╱
             ╲────────────────────╱
                       │
                       ▼
            ╱──────────────────────╲
            ╲   DATABASE DESIGN     ╱
             ╲────────────────────╱
                       │
                       ▼
            ╱──────────────────────╲
            ╲    VISUAL BASIC       ╱
             ╲────────────────────╱
                       │
                       ▼
            ╱──────────────────────╲
            ╲    FORMS DESIGN       ╱
             ╲────────────────────╱
                       │
                       ▼
            ┌──┬──────────────────┬──┐
            │  │  AUTOCAD SCRIPT   │  │
            └──┴──────────────────┴──┘
                       │
                       ▼
            ╱──────────────────────╲
            ╲      AUTOCAD          ╱
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            ╲   AUTOCAD DRAWING     ╱
             ╲────────────────────╱
                       │
                       ▼
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            ╲  AUTOCAD EXT. DB CONF.╱
             ╲────────────────────╱
                       │
                       ▼
            ╱──────────────────────╲
            ╲  MS ACCESS ODBC SETUP ╱
             ╲────────────────────╱
                       │
                       ▼
            ╱──────────────────────╲
            ╲  Acad / Access         ╱
            ╲   CONNECTION          ╱
             ╲────────────────────╱
                       │
                       ▼
            ╱──────────────────────╲
            ╲     DRAWING           ╱
            ╲   Objects Linking.    ╱
             ╲────────────────────╱
                       │
                       ▼
            ┌──┬──────────────────┬──┐
            │  │   MAIN PROGRAM    │  │
            └──┴──────────────────┴──┘
                       │
                       ▼
             ╱────────────────────╱
            ╱       OUTPUT        ╱
           ╱────────────────────╱
                       │
                       ▼
            ┌──────────────────────┐
            (        STOP           )
            └──────────────────────┘
```

MAIN MODULE FLOW CHART

DATA CAPTURE

46

LANDS DATA CAPTURE

CHAPTER FOUR

LAND INFORMATION SYSTEM IMPLEMENTATION

4.1   Introduction

Existing standard Computer applications do not just come to the surface without rigorous stages of processes. LIS application software for the computer as analyzed and designed in the foregoing chapters has no exception. All the components required to make this LIS application a reality have to be blended together to produce a single whole that will perform the specific objective.

The components, MS Access for DBMS, AutoCAD for scaleable graphics are blended into one executable application through MS Visual Basic programming interface employing the use of Control / Form objects and codes.

4.2   Implementing And Accessing The LIS Databases

Four databases were created in MS Access with their tables and fields as per the design in chapter three. These are LANDAPP.MDB, LANDREV.MDB, MAPS.MDB and LIS.MDB. They were created and located in C:\PROJECT\LIS directory.
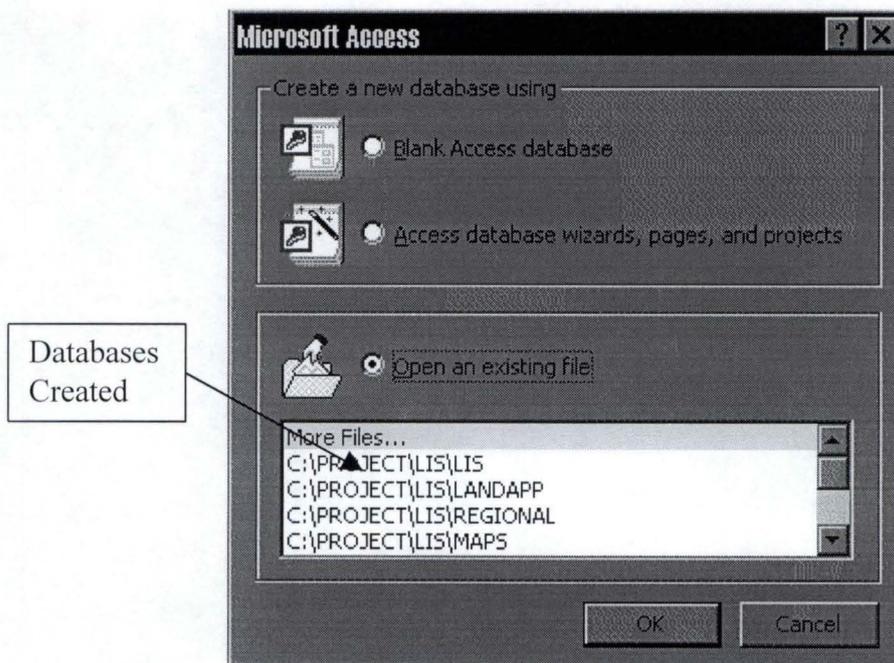
Figure 4.1 **THE DATABASE FILES**
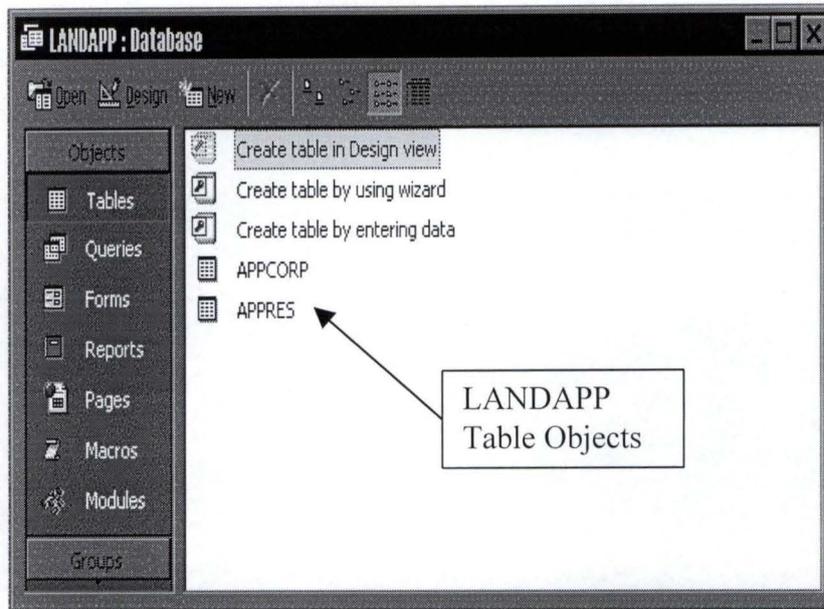
Figure 4.2   LANDAPP.MDB DATABASE
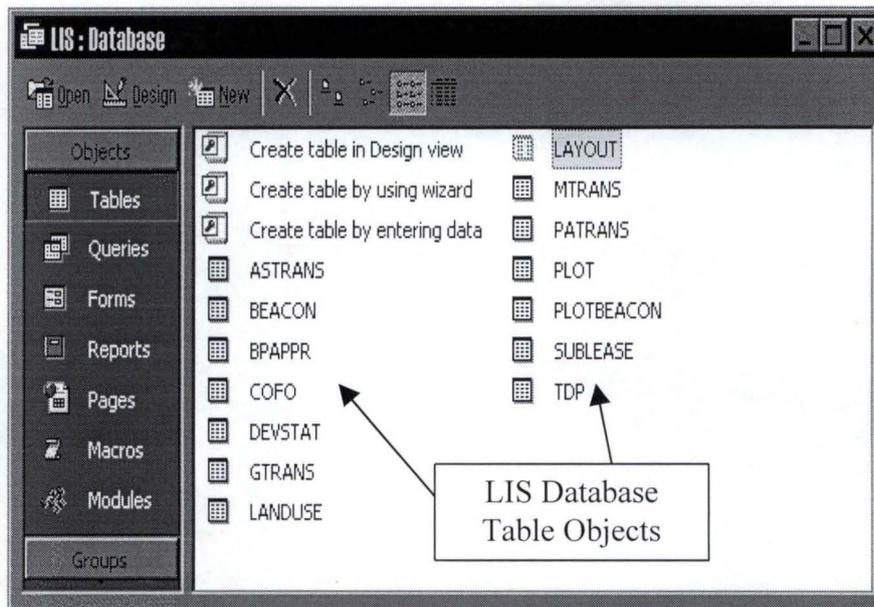
Figure 4.3   LIS.MDB DATABASE

4.2.1   Accessing The Databases With Visual Basic

This is achieved through database control facilities provided in Visual Basic programming software.

The procedure involve placing a form object in the project window and saving it with a name appropriate to the operation (e.g. APPRES.frm for Residential Applicant data capture operation) and setting its properties which include the reference name that

begins with the prefix 'frm', setting its backcolor (background colour), the border style, screen position and size as well as the windows state (min, max. and norm.) at run time.

The Data Control object is then double clicked from the Toolbox to place it in the Form object. The following properties are then set for the Data Control object from the property window:

i)   DatabaseName   -   full database file name and path;

ii)   RecordSet   -   table name;

iii)   Connect   -   default is Access;

iv)   DataControl Name   -   same as table name;

v)   DataControl Caption -   same as table name.
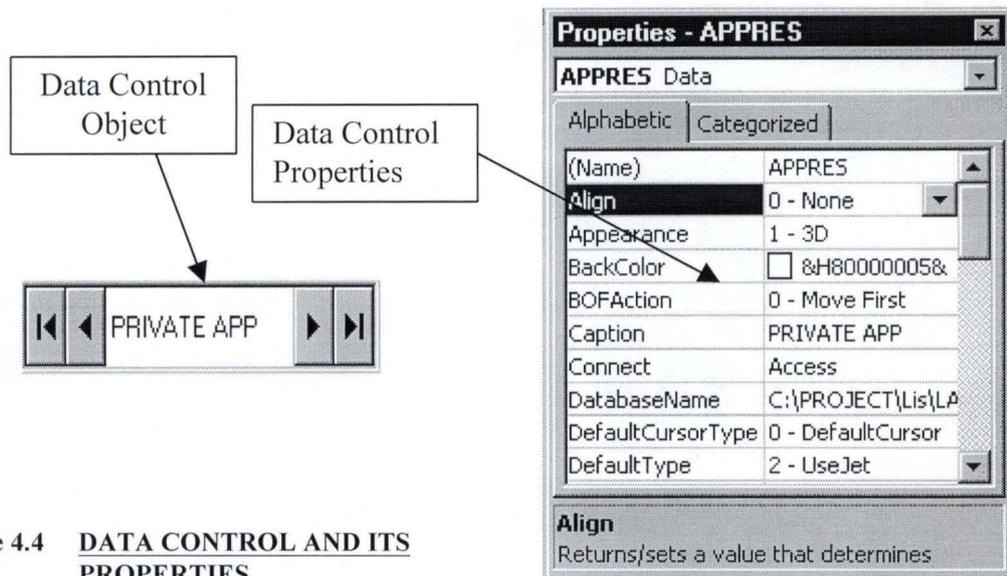
Figure 4.4   DATA CONTROL AND ITS PROPERTIES

All the fields in a table are bounded to the form at various positions through Textbox controls. This is done by double clicking the Textbox control from the Toolbox.
The Textbox is then positioned, the size adjusted and label attached to it through the Label Control available in the Toolbox.

The binding properties are selected from the property window as follows:

i)   Textbox reference name with prefix 'txt';

ii)   DataSource name   -   database name and path;

iii)   RecordSource   -   table name;

iv)   DataField   -   field name.

It is important to note that once the DataControl is placed in the Form and bounded to the existing data base, all the above mentioned database features are accessible in the Combobox provided against their property names.

This procedure of opening a project form, placing a data control and binding textboxes to all fields available in a table was repeated for all the tables in databases in this exercise. Thus making the whole databases accessible to Visual Basic.

4.2.2   Preparing The Databases For Use As External Databases To Other Applications

Microsoft Access, as a software does not support information Schema or Catalog, which is applicable to most DBMS and required by AutoCAD.

New databases therefore has to be created consisting two reference tables each that emulates the schema for all the existing databases created in MS Access for use as external database to AutoCAD and its objects.

Similarly to create the information schema for this project, the following procedures was adopted

a)   Start MS Access and create a new database with the name "Infoschema" in the
        C:/Project/LIS directory.

b)   Open a new table in design view in the Infoschema database and in the
        fieldname box enter CATALOG-NAME as the fieldname and select text as its
        type. At the second field, enter SCHEMA-NAME as the next field and select
        text as the type.

c)   Click on save to save the table with the name SCHEMATA and click on No to
        primary key prompt. Close the table design.

d)   To add reference data to the SCHEMATA table, select the table and click on open and then add NULL to the Catalog-Name field, then add the name and full path of the existing database to be accessed to the Schema-Name field or column (e.g C:\Project\LIS\Landapp.mdb), then close the table.

e)   Open a new table at design view and enter the following text fields:
        TABLE_CATALOG;
        TABLE_SCHEMA;
        TABLE_NAME;
        TABLE_TYPE;
and save with the name "Tables" then choose NO to primary key setting.

f)   To add reference data to the "Tables" table, select the table and click on open and complete the fields as follows:
        Under TABLE_CATALOG enter NULL;
        Under TABLE_SCHEMA enter C:\Project\LIS (landapp.mdb);
        Under TABLE_NAME enter APPRES;
        Under TABLE_TYPE enter 'base table'.

Repeat item (f) for all tables required in LANDAPP.MDB database. Item a-f has to be repeated for all existing databases required for use as external database to AutoCAD application.

4.2.3   Linking AutoCAD Objects With The Databases

It is important to note that AutoCAD does not recognize Microsoft Access DBMS directly, but through Opened Data Base Connectivity (ODBC) program. ODBC is an independent application that is available in the control panel of most systems as a 32-bit interface connection between application and various database management systems.

To configure the ODBC for use with MS Access proceed as follows:

i)   Double click ODBC icon in the control panel;

ii)   Click on "Add";

iii)   Enter User Data source name (DSN) e.g. MS Access and enter the description;

iv)   Under Databases, click on select and then browse through the project directory "C:\Project\LIS" for the required database file. Note that this database file must have an information schema;

v)   Click on OK 3 times to close the select Databases, ODBC-MS Access setup and ODBC DataSource Administrator dialog windows respectively.
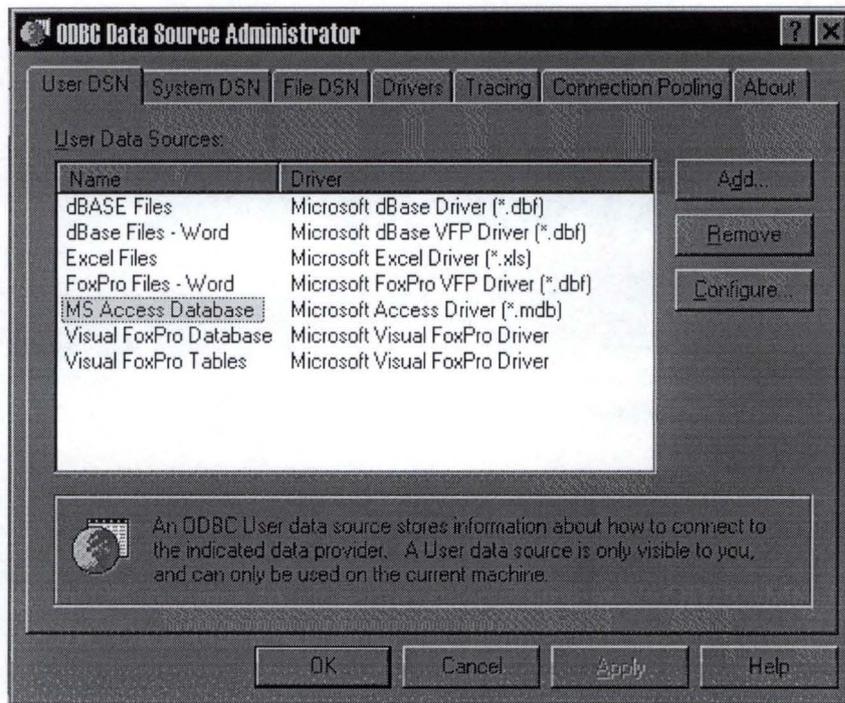
Figure 4.5   ODBC CONFIGURATION

Using AutoCAD External Database Configuration Utility to setup MS Access, proceed as follows:

a)   From the start menu choose AutoCAD R14 then select 'External Database Configuration' and click on Add. From the New Environment Window, select ODBC and enter the environment name as MS Access (same name as in the ODBC setup) in the space provided and click ok.

b)   Click on the General tab and select 'Not Supported' at the 'Set Schema' provision.

c)   At information Schema, enter the name of the information Schema defined in MS Access for that database, e.g. C:\project\LIS\infoschema.mdb, then choose apply and click on ok.
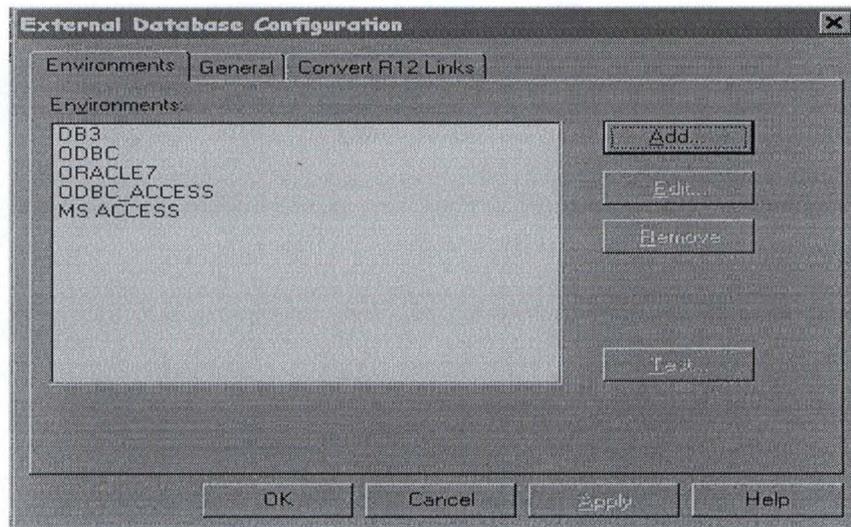
Figure 4.6   EXTERNAL DATABASE CONFIGURATION

Establishing Connectivity to the configured MS Access environment:

i)   Start AutoCAD and click on the tools menu then choose External Database and select Administration.

ii)   Double click on MS Access in the Database objects list and click on connect. At user name, enter 'admin' and click on OK leaving the space for password blank.

iii)   In the database selection area, click on Schema and select the name of the reference database from the list of database objects, then click on table to list all the tables in the reference database.
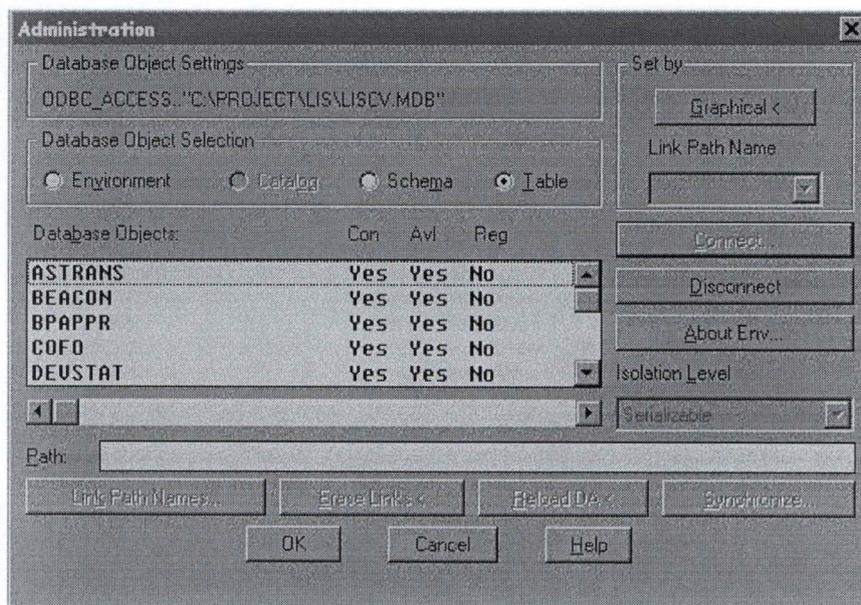
Figure 4.7   AUTOCAD – DATABASE CONNECTION

Setting link paths for tables of all connected databases. This is to enable the tables to be linked to AutoCAD objects through their key fields. To achieve this proceed as follows:

i)   From the AutoCAD Drawing Editor, click on tools and select External Database then click on Administration. Select an environment, schema and table from the database objects window, while on the selected table click on Link Path Names so as to define the key column for the table.

ii)   In the link Path names box, select the key column and then select 'ON'

iii)   Under the link path, enter a new Link Path Name for the selected column, and then choose New.

iv)   Choose close and then click on Ok when finished.
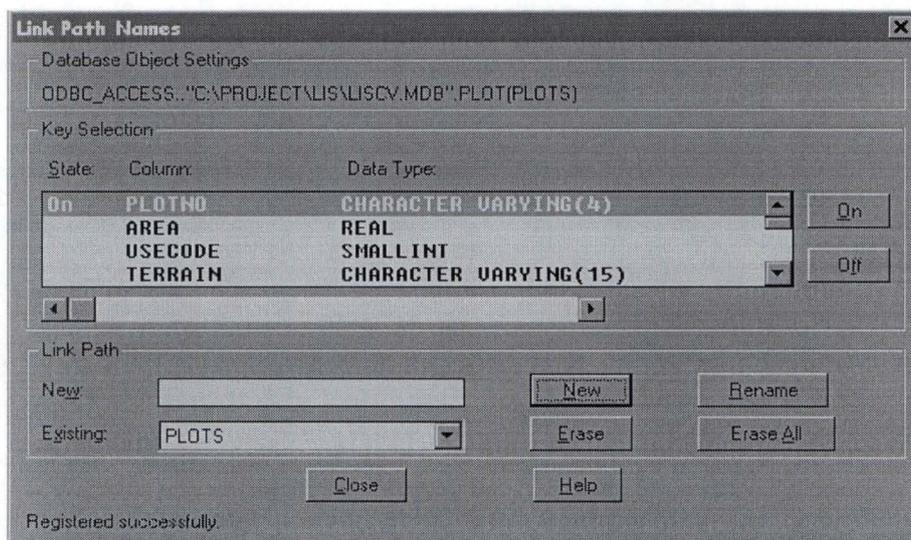
Figure 4.8 <u>SETTING LINK PATHS</u>

Linking AutoCAD Objects to a row in the table of a database:

i)   After the connection between AutoCAD and the External Database is established an AutoCAD drawing is opened, then from the Tools menu, choose external Database and Select Rows. From the available linked path names, select a row in the current table and choose Make Link and click on the drawing object (s) to be linked to the selected row.

Repeat the process for all drawing objects to be linked to the various rows of the table. E.g. linking plot numbers on the layout to plots in the allocation table in the database.
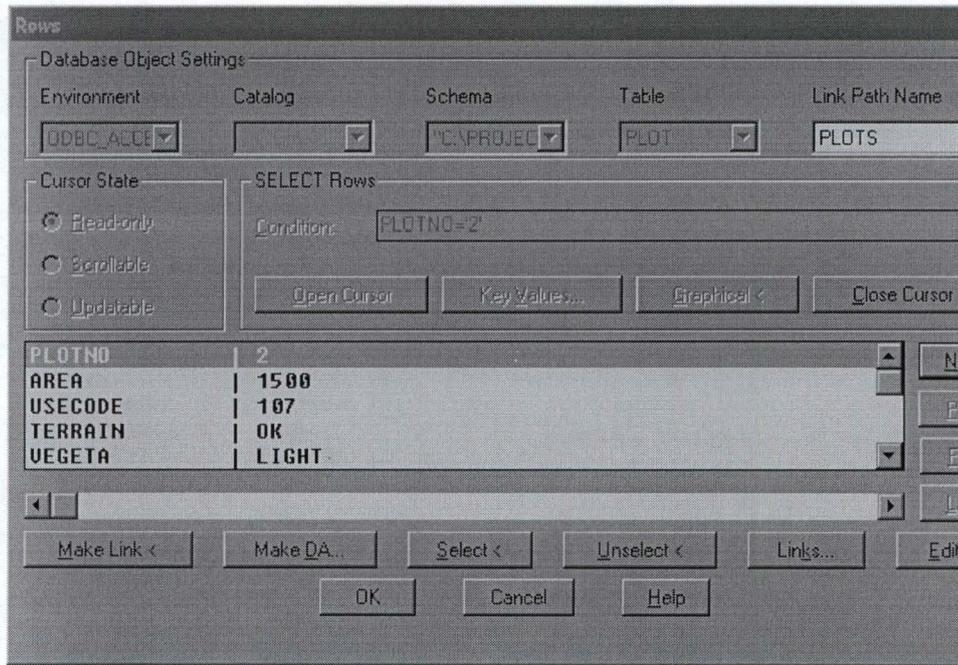
Figure 4.9   LINKING AUTOCAD OBJECTS TO THE DATABASE
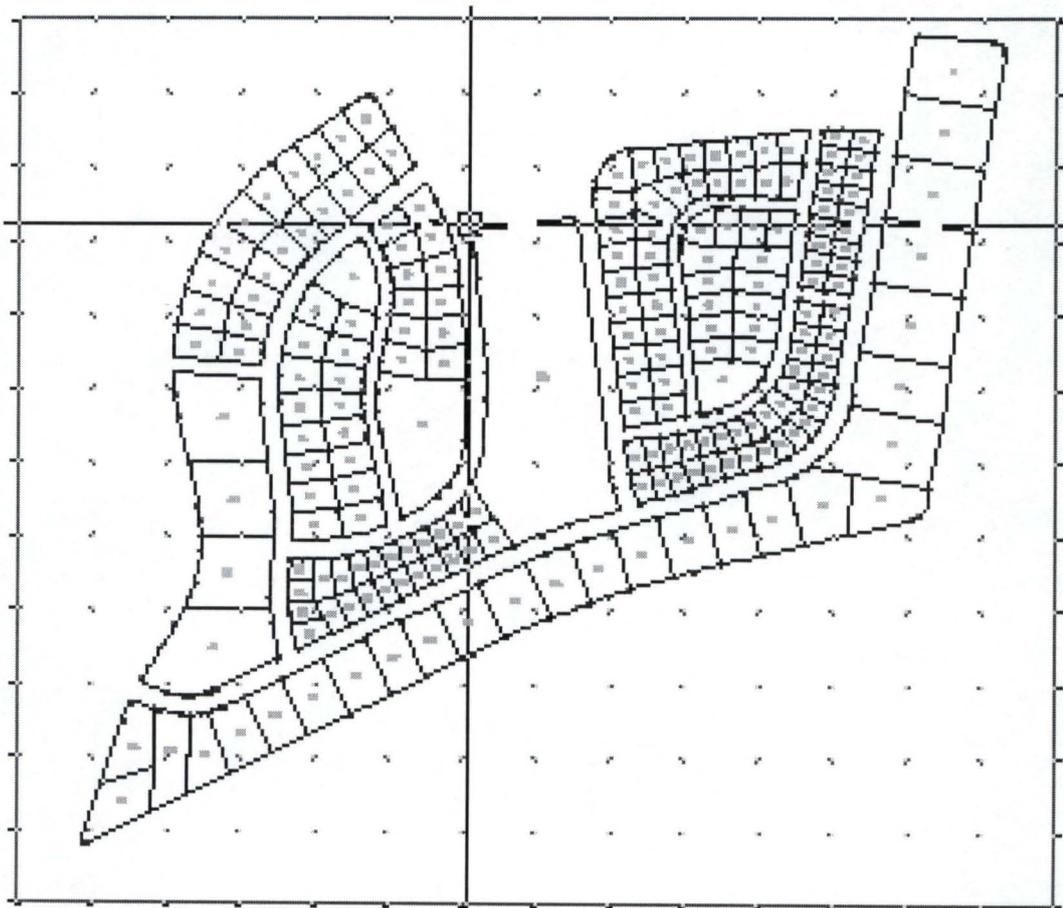
Figure 4.10   LAYOUT OF PART OF JABI DISTRICT

4.2.4 Querying The Database Linked With AutoCAD

Querying the database is achieved through the use of codes generated in Visual Basic. These codes are attached to action objects such as command buttons and activated at run-time through the action of mouse pointing and clicking or through a combination of keys on the keyboard. For instance, to obtain information about the allocation details of a plot requires pointing and clicking on the appropriate command button in the relevant form.

Similarly, for all information obtainable about parcels of land that has been computerised and linked to AutoCAD. The available information about each parcel of land is presented in the command buttons with the appropriate codes embedded.

4.3 Testing The Program

Program testing involves running the LIS application with real life data on the same environment (the computer that was used in writing the program), to ascertain the correctness of the program in terms of Logic Errors.

Sample of life data used in this project include list of Land Survey coordinates for property beacons (PBs) in JABI (B4) district and list of land applicants awaiting plot allocation.

LAND

INFORMATION

SYSTEM

AUTHOR: Julius B M Sambo, PGD/MCS/98/99/739

VERSION 1.0.

OK
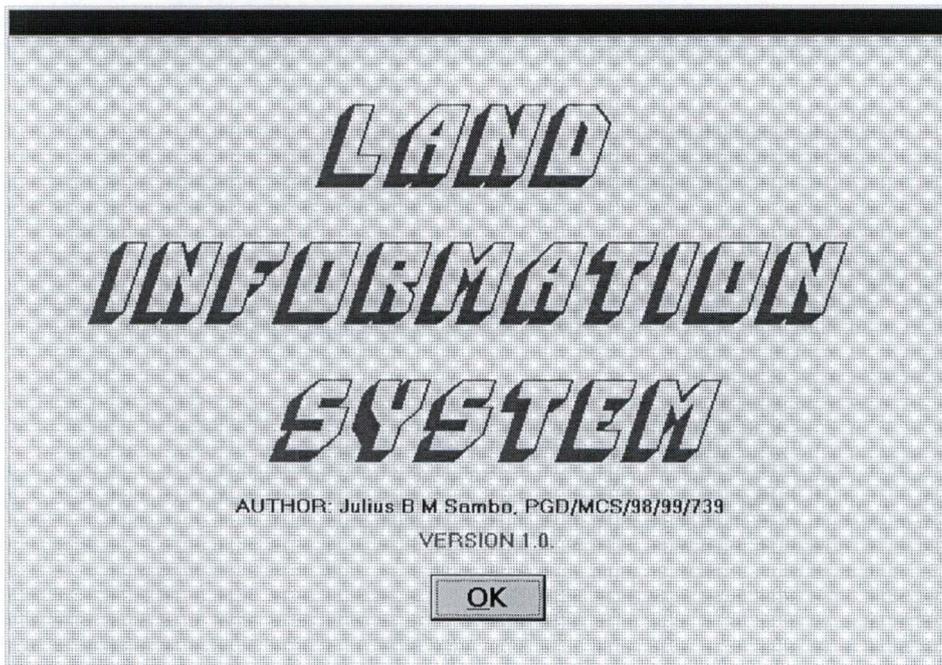
Figure 4.11 LIS APPLICATION INTRODUCTORY SCREEN
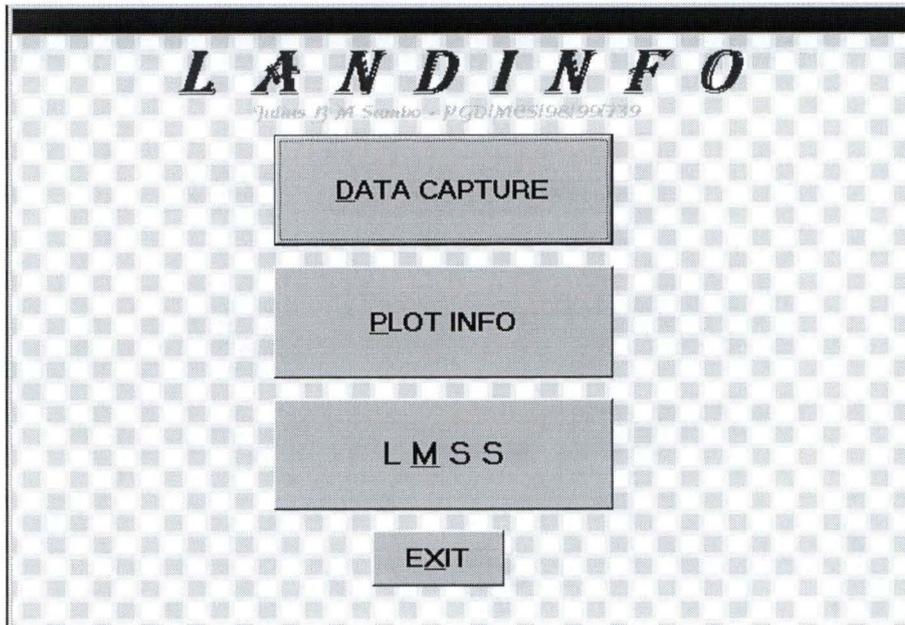
Figure 4.12   **PROGRAM MAIN SCREEN**
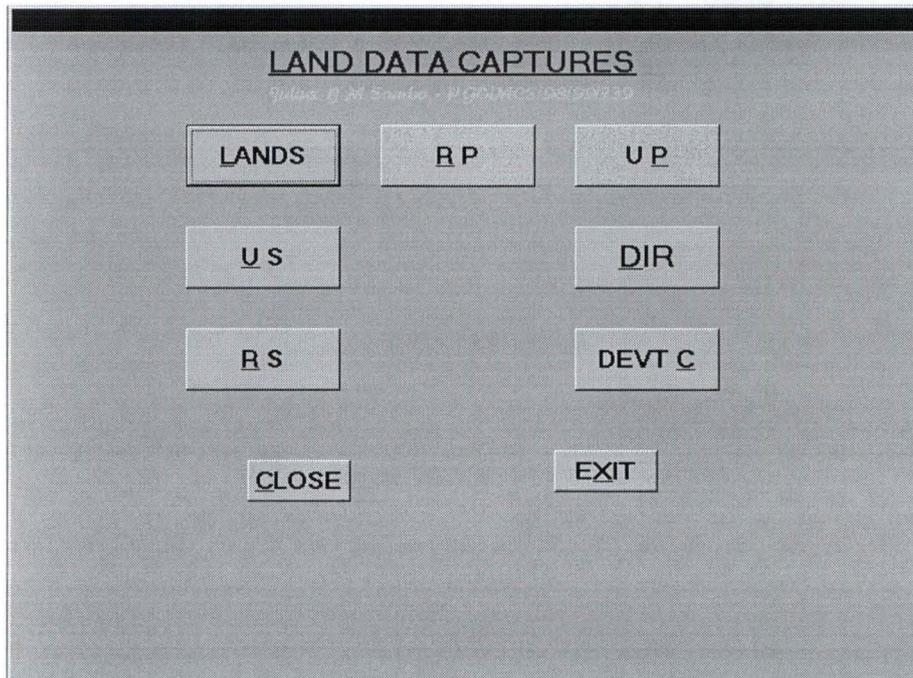
Figure 4.13   **GENERAL DATA CAPTURE SCREEN**
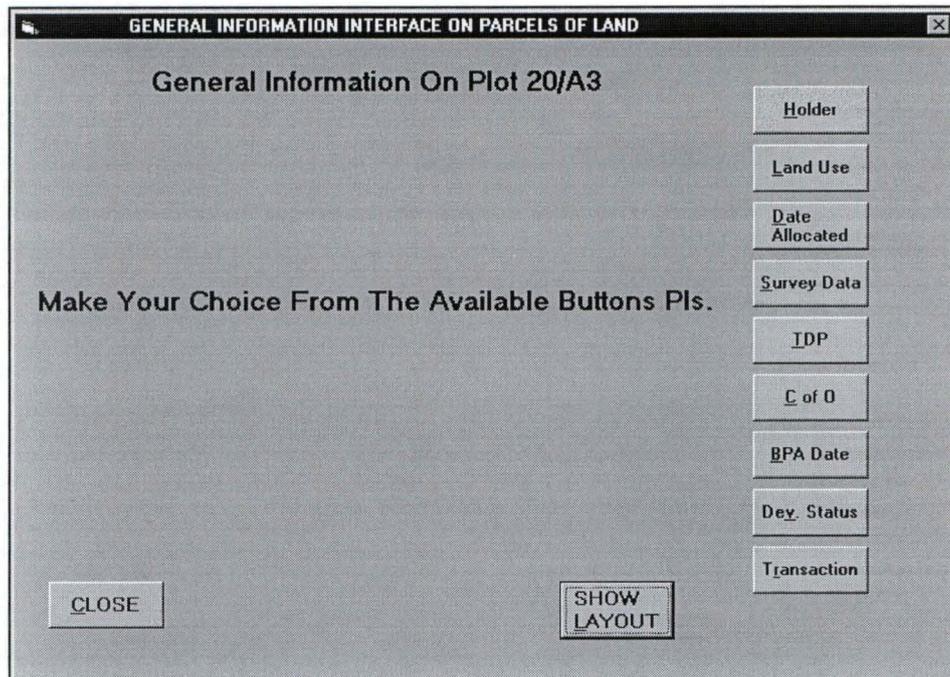
Figure 4.14   GENERAL PLOT QUERY INTERFACE
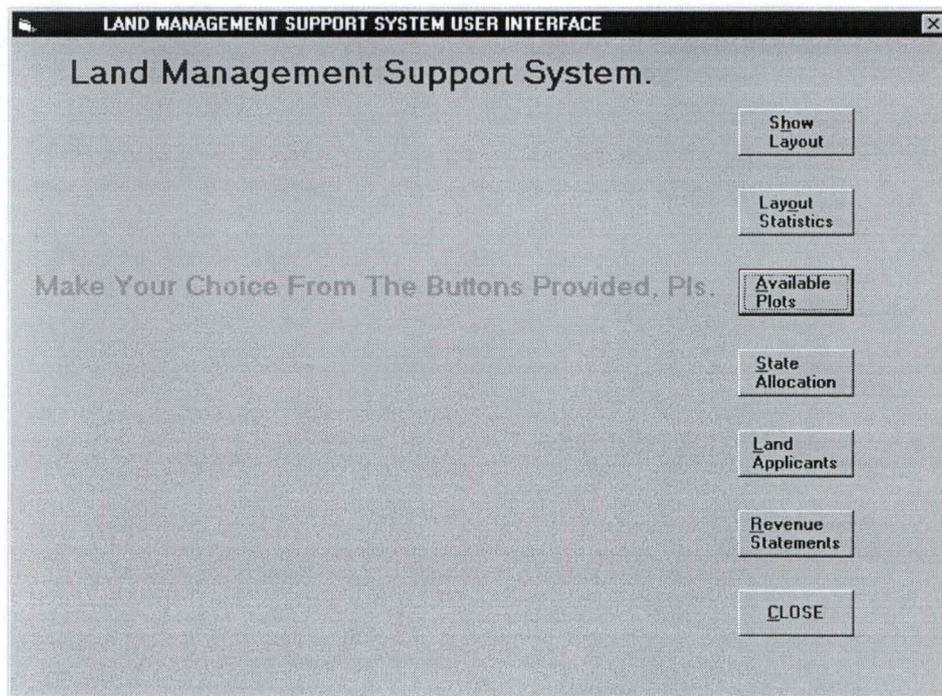
Figure 4.15   LAND MANGEMENT SUPPORT SYSTEM INTERFACE

Figure 4.16 DATA CAPTURE SCREEN

4.4   Program Implementation

Implementing an application software involve making the program to run effectively on computer system other than that used in developing the software. This involves writing a set-up program that configures the target computer for use with the application.

Function of the set-up program is to:

i)   Create the required directories or folders for files;

ii)   Create directories/folders for data files necessary for the program;

iii)   Install all special utility programs used during program design;

iv)   Copy all the relevant data and program files from the application disk to the appropriate new directories in the target computer.

In this exercise, the relevant directories are PROJECT and LIS (sub-directory), (C:\PROJECT\LIS). The data files include all the database files that were created at design time and located in the C:\PROJECT\LIS sub-directory.

The program or application files are the .EXE, .DLL, .OCX and other files that were generated at design and compilation time.

Special utility programs include the ODBC (Opened Data Base Connectivity) set-up program necessary for configuring the target system for use in the ODBC environment as required in this application

CHAPTER FIVE

LIS DOCUMENTATION AND CONCLUSION

5.1 Introduction

Documentation at this stage of an application development involves the programmer's directive on the effective use of the product. This LIS application has a lot of inbuilt documentation that makes the whole program 'User Friendly'. However, this chapter intends to take the user through those important areas necessary for effective and stress less use of the application.

5.2 LIS Application Documentation

This Land Information System (LIS) application is code-named *LANDINFO* with an executable file called LANDINFO.EXE. The application is packaged into program files, data files and set-up files all copied onto CD ROM ready for distribution. The application data structure is controlled by the underlying database management system (MS Access).

5.2.1 System Requirement

LANDINFO system requirement include any micro-processing computer with the following Hardware and Software setup:

i   80486 or later micro-processor;

ii   32 MB RAM or higher;

iii   1GB disk space for programs files and data;

iv   CDROM Drive;

v   Mouse or any other printing device;

vi   Windows 95 or later;

vii   Microsoft office 97 or later;

viii   Autodesk AutoCAD release 14 or later.

5.2.2 Installing The Application

The LANDINFO CD contains setup, programs and data files. The setup files include the application installation file as well as ODBC Setup file.

The ODBC setup has to be installed first before the LANDINFO setup. Because LANDINFO.EXE makes use of ODBC program, so the target computer must be installed with ODBC necessary for LANDINFO.

To install the ODBC program:

i)   Insert the LANDINFO program disk into the CDROM drive;

ii)   Click on browse in the run dialog box and select the CDROM drive;

iii)   Double click ODBC- setup icon and follow on screen instructions.

Similarly to install LANDINFO application, double click the setup icon and wait for program to create the necessary folders and to copy all the appropriate program and data files to their respective folders.

5.2.3 Starting & Quitting LANDINFO

LANDINFO can be activated, loaded or started through double clicking in windows explorer at the LANDINFO.EXE file, which is located in the project folder. It can also be started through Run in the start menu.

When started, the user should follow the on-screen instruction up to the main program window. In this window, the program items are Data Capture, PlotInfo and LMSS. Data Capture is for entering data into the various databases. PlotInfo leads to information about particular parcel of land (plot). LMSS on the other hand is the Land Management Support System that leads to summary information about Applicants, Plot Allottees, Revenue and Layouts.

Clicking any of these items with the left mouse button leads to other windows with items, which are self-explanatory. To return to previous window click on Close at any window except the window with the main items where there is no Close but Exit.

Quitting the application is possible at any time and any window by clicking on Exit or pressing the combination of Alt and X keys at once on the keyboard.

5.3   Project Summary

LANDINFO, which was developed using Microsoft Visual Basic Programming Software, has Microsoft Access at the background as the Data Base Management System (DBMS). The CAD program (AutoCAD) is involved as a utility program for the graphic analysis of the land and the features on and around it. All these major independent application programs (DBMS/CAD) are controlled in the background by the front-end Visual Basic product (LANDINFO).

Integrating AutoCAD and MS Access posed some difficulties and incompatibility as a result of MS Access inability to support Catalogue system in data base management. MS Access therefore had to be linked with an ODBC - Opened Data Base Connectivity program, so as to make AutoCAD recognize it, as AutoCAD recognizes ODBC structures and environment. Thus MS Access/AutoCAD integration becomes possible, thereby actualizing AutoCAD objects linking to the database in MS Access.

Computerized Land Information System application development involving CAD program in addition to the traditional DBMS has added more impetus to the desire to see the whole application working effectively. That is, not only on the computer that was used to develop it, but also on all microprocessor computers, as an independent executable program.

5.4   Problems And Recommendations

In all project exercises, problems can seldom be completely eluded. From all the precautions taken in information gathering, data selection and the project strategies, un-suspected and uncountable numbers of problems were encountered. Some of the information gathered were not necessary, some of the selected data were realized to be wrong while some of the programming strategies were either invalid or completely did not work out.

The cause of these problems was later traced to lack of adequate exposure and or sheer incompetence in Visual Basic Programming language. Some times, familiarization with textbooks and or application manuals alone does not guarantee successful programming implementation. Practice and Practical knowledge of the applications structure and operations is considered very crucial in information system development involving software integrations and cross-references.

As a solution to most of the problems encountered, several approaches were made to the problems through trials and errors of the enormous possibilities provided by Visual Basic.

To reduce the number of problems in similar system development therefore, it is recommended that all application programs required in the project must be available in the computer to be used for the system development. The computer system to be used must have enough memory capacity and disk space for all the required software. All program files and data must be in the same folder. Latest windows based programming languages must be taught or introduced in the PGD/MCS program, to enable students to cope with the realities of the day in computer programming

5.5   Cost And Benefit Analysis Of The Project

The benefits of the new system is going to be in terms of user satisfaction, better management decisions, timely and accurate information available to the user, cheaper data processing procedures as less man-hours will be recorded per particular process, and so on and so forth.

Cost of the system is calculated on the following lines:

Equipment Cost:

Computer Hardware – 3 Workstations –

1 PC @	N200,000.00
- 1 Scanner @	N500,000.00
- 1 Digitizers @	N300,000.00
- =	N3,000,000.00

- 7 PCs @ N200,000.00 =	N1,400,000.00
- 2 Laserjet Printers @ N150,000.00 = N300,000.00
- 1 Network Server @	N300,000.00
- 10 N I C @ N2,500.00 =	N25,000.00

-	500m Coaxial cable @	N20,000.00
-	10 UPS units @ N40,000.00 =	N400,000.00
-	10 Stabilizers @ N10,000.00 =	N100,000.00

-	Installation of the whole lot -	N200,000.00
-	Software development –	N300,000.00
-	16 Staff recruitment / training -	N200,000.00

Operating Cost:

-	Maintenance cost –	N80,000.00
-	Housing -	N200,000.00
-	Generating set	N100,000.00
-	Utilities -	N150,000.00
-	Disks and Stationery -	N100,000.00

Projected Total Cost of the Project   **N6,875,000.00**

5.6   Conclusion

In conclusion, comprehensive computerised Land Information System is a serious business that requires tremendous amount of efforts, time and patience. This is true even for the advanced computer programmer.

Choice of the DBMS was realized to be very important in reducing the amount of efforts involved in integrating AutoCAD/Database. MS Access was chosen not because it is the best and most rugged DBMS but because it is commonly available.

AutoCAD also was chosen not because of its simplicity in database management but because of its popularity and availability to the author.

My choice of Visual Basic Programming language was based on my exposure to text in the manuals (VB 5.0 in 21 days). That is without formal practice of any kind on Visual Basic before the commencement of the project. This lack of prior adequate exposure to the chosen application software lead to the insurmountable efforts and time expended on this project.

However, The product of all these efforts has brought about a wider spectrum in my understanding of computer operations and programming in windows. This is a feat, which was hitherto impossible in my ability to use and program the computer effectively.

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APPENDIX A

PROGRAM SOURCE CODE FOR SOME SELECTED
MODULES AND SUB-ROUTINES

Plot Allocation Screen

```
Option Explicit

Private Sub cmdCANCEL_Click()
   Unload Me
End Sub

Private Sub cmdClose_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmDATACAPTURE.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdDone_Click()
   lblAllocate.Caption = "Report:-  Plot Number " & txtPlots.Text & " is Now
Committed to File Number " & txtApplicants.Text
End Sub

Private Sub cmdOK_Click()
   Screen.MousePointer = vbHourglass
   Dim dbs As Database
   Set dbs = OpenDatabase("c:\project\lis\LIS.mdb")
   'On Error Resume Next
   dbs.Execute " INSERT INTO Allocation " & "(PLOTNO, AREA, USECODE,
REFNO, SURNAME, ONAMES, ADDRESS) " & "SELECT PLOT.PLOTNO, AREA,
USECODE, APPRES.REFNO, SURNAME, ONAMES, ADDRESS " & "FROM PLOT,
APPRES " & "WHERE PLOTNO = txtPlots.Text AND REFNO = txtApplicants.Text;"
   dbs.Close
   txtPlots.Text = ""
   txtApplicants.Text = ""
   lblAllocate.Caption = ""
   dbgPlots.SetFocus
   Screen.MousePointer = vbDefault
End Sub

Private Sub dbgAppcorp_DblClick()
   txtApplicants.Text = Data3.Recordset("REFNO")
End Sub

Private Sub dbgAppres_DblClick()
   txtApplicants.Text = Data2.Recordset("REFNO")
```

```
End Sub

Private Sub dbgPlots_DblClick()
   txtPlots.Text = Data1.Recordset("PLOTNO")
End Sub

Private Sub Form_Load()

End Sub
```

Data Catpture Screen

```
Private Sub cmdClose_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmMAIN.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdDEVTC_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmDEVTC.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdDIR_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmDIR.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdEXIT_Click()
   End
End Sub

Private Sub cmdLANDS_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmLANDS.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdRegPlan_Click()
   Screen.MousePointer = vbHourglass
   'Unload Me
   'frmURP.Show
```

```vb
      Beep
      Beep
      MsgBox ("Function Not Yet Ready Please")
      Screen.MousePointer = vbDefault
End Sub


Private Sub cmdSURVEYS_Click()
      Screen.MousePointer = vbHourglass
      Unload Me
      frmSURVEYS.Show
      Screen.MousePointer = vbDefault
End Sub


Private Sub cmdURP_Click()
      Screen.MousePointer = vbHourglass
      Unload Me
      frmURP.Show
      Screen.MousePointer = vbDefault
End Sub


Private Sub cmdZONALC_Click()
      Screen.MousePointer = vbHourglass
      Unload Me
      frmREGIONALSV.Show
      Screen.MousePointer = vbDefault
End Sub
```

Layout Data Capture Screen

```vb
Private Sub cmdADDRECORDS_Click()
      Screen.MousePointer = vbHourglass
      LAYOUT.Recordset.AddNew
      txtLAYCODE.SetFocus
      Screen.MousePointer = vbDefault
End Sub


Private Sub cmdClose_Click()
      Screen.MousePointer = vbHourglass
      Unload Me
      frmURP.Show
      Screen.MousePointer = vbDefault
End Sub


Private Sub cmdEXIT_Click()
      End
End Sub
```

Land Management Support System (LMSS) Screen

```
Option Explicit

Private Sub cmdApplicants_Click()
    lblLayout.Caption = "Land Applicants Awaiting Plot Allocation"
    Beep
    MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdAvailable_Click()
    lblLayout.Caption = "Unallocated Plots In The District"
    Beep
    MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdClose_Click()
    Unload Me
    frmMAIN.Show
End Sub

Private Sub cmdRevenue_Click()
    lblLayout.Caption = "Land Revenue Collection Analysis"
    Beep
    MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdShow_Click()
    lblLayout.Caption = "District Layout Analysis"
    Beep
    MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdStateAlloc_Click()
    lblLayout.Caption = "State Allocation Analysis"
    Beep
    MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdStatistics_Click()
    lblLayout.Caption = "District Layout Statistics"
    Beep
    MsgBox ("No Code Yet, Please.")
End Sub

Private Sub Form_Load()
    lblLMSS.Caption = "Land Management Support System"
End Sub
```

APPENDIX B

SOME SELECTED OUTPUT SCREENS FOR LAND MANAGEMENT SUPPORT SYSTEM (L M S S)

Unallocated Plots Of Land In The District

Unallocated Plots In The District

Applicants Awaiting Plot Allocation

Land Applicants Awaiting Plot Allocation

APPENDIX A

PROGRAM SOURCE CODE FOR SOME SELECTED
MODULES AND SUB-ROUTINES

Plot Allocation Screen

```
Option Explicit

Private Sub cmdCANCEL_Click()
   Unload Me
End Sub

Private Sub cmdClose_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmDATACAPTURE.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdDone_Click()
   lblAllocate.Caption = "Report:-  Plot Number " & txtPlots.Text & " is Now
Committed to File Number " & txtApplicants.Text
End Sub

Private Sub cmdOK_Click()
   Screen.MousePointer = vbHourglass
   Dim dbs As Database
   Set dbs = OpenDatabase("c:\project\lis\LIS.mdb")
   'On Error Resume Next
   dbs.Execute " INSERT INTO Allocation " & "(PLOTNO, AREA, USECODE,
REFNO, SURNAME, ONAMES, ADDRESS) " & "SELECT PLOT.PLOTNO, AREA,
USECODE, APPRES.REFNO, SURNAME, ONAMES, ADDRESS " & "FROM PLOT,
APPRES " & "WHERE PLOTNO = txtPlots.Text AND REFNO = txtApplicants.Text;"
   dbs.Close
   txtPlots.Text = ""
   txtApplicants.Text = ""
   lblAllocate.Caption = ""
   dbgPlots.SetFocus
   Screen.MousePointer = vbDefault
End Sub

Private Sub dbgAppcorp_DblClick()
   txtApplicants.Text = Data3.Recordset("REFNO")
End Sub

Private Sub dbgAppres_DblClick()
   txtApplicants.Text = Data2.Recordset("REFNO")
```

```
End Sub

Private Sub dbgPlots_DblClick()
   txtPlots.Text = Data1.Recordset("PLOTNO")
End Sub

Private Sub Form_Load()

End Sub
```

Data Catpture Screen

```
Private Sub cmdClose_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmMAIN.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdDEVTC_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmDEVTC.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdDIR_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmDIR.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdEXIT_Click()
   End
End Sub

Private Sub cmdLANDS_Click()
   Screen.MousePointer = vbHourglass
   Unload Me
   frmLANDS.Show
   Screen.MousePointer = vbDefault
End Sub

Private Sub cmdRegPlan_Click()
   Screen.MousePointer = vbHourglass
   'Unload Me
   'frmURP.Show
```

```vb
      Beep
      Beep
      MsgBox ("Function Not Yet Ready Please")
      Screen.MousePointer = vbDefault
End Sub

Private Sub cmdSURVEYS_Click()
      Screen.MousePointer = vbHourglass
      Unload Me
      frmSURVEYS.Show
      Screen.MousePointer = vbDefault
End Sub

Private Sub cmdURP_Click()
      Screen.MousePointer = vbHourglass
      Unload Me
      frmURP.Show
      Screen.MousePointer = vbDefault
End Sub

Private Sub cmdZONALC_Click()
      Screen.MousePointer = vbHourglass
      Unload Me
      frmREGIONALSV.Show
      Screen.MousePointer = vbDefault
End Sub
```

Layout Data Capture Screen

```vb
Private Sub cmdADDRECORDS_Click()
      Screen.MousePointer = vbHourglass
      LAYOUT.Recordset.AddNew
      txtLAYCODE.SetFocus
      Screen.MousePointer = vbDefault
End Sub

Private Sub cmdClose_Click()
      Screen.MousePointer = vbHourglass
      Unload Me
      frmURP.Show
      Screen.MousePointer = vbDefault
End Sub

Private Sub cmdEXIT_Click()
      End
End Sub
```

Land Management Support System (LMSS) Screen

```vb
Option Explicit

Private Sub cmdApplicants_Click()
  lblLayout.Caption = "Land Applicants Awaiting Plot Allocation"
  Beep
  MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdAvailable_Click()
  lblLayout.Caption = "Unallocated Plots In The District"
  Beep
  MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdClose_Click()
  Unload Me
  frmMAIN.Show
End Sub

Private Sub cmdRevenue_Click()
  lblLayout.Caption = "Land Revenue Collection Analysis"
  Beep
  MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdShow_Click()
  lblLayout.Caption = "District Layout Analysis"
  Beep
  MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdStateAlloc_Click()
  lblLayout.Caption = "State Allocation Analysis"
  Beep
  MsgBox ("No Code Yet, Please.")
End Sub

Private Sub cmdStatistics_Click()
  lblLayout.Caption = "District Layout Statistics"
  Beep
  MsgBox ("No Code Yet, Please.")
End Sub

Private Sub Form_Load()
  lblLMSS.Caption = "Land Management Support System"
End Sub
```

APPENDIX B

SOME SELECTED OUTPUT SCREENS FOR LAND MANAGEMENT SUPPORT SYSTEM (L M S S)

Unallocated Plots Of Land In The District

Applicants Awaiting Plot Allocation