

**THE POTENTIAL OF SLIMPAC AS A
MANAGEMENT INFORMATION SYSTEM SOFTWARE
- AN OVERVIEW**

by

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Abstract

The selection of GIS software applications vary with the purposes and requirements of using it. The two major applications for GIS software are for management/information and design analysis. The surveyors Land Information Management PACKAGE (SLIM) is basically developed for management or monitoring purposes and some design applications. Studies on areas of applications, specifications, operations, data sources, data organisations and information presentation shows the potentials of SLIMPAC as a Management Information System Package.

INTRODUCTION

SLIMPAC is a computer application system for capturing, processing, organising and displaying spatial and related descriptive data. It is designed to input, store, manipulate, display and output land survey data; spatial and non-spatial. It can be used to solve many of the current problems associated with managing and accessing map and map related information (Parker, et al, 1986). SLIMPAC is designed and developed at the Department of Surveying, University of Newcastle upon Tyne. The development process started in 1985 and was upgraded to a new version in 1988. In mid 1989, SLIMPAC was introduced to the British computer market as a Management Information System package; a tool of a Geographic Information System software package. SLIMPAC has its own characteristics, where descriptive information and map features are stored independently.

SLIMPAC is mainly based on two commercial computer software packages i.e. AutoCAD (graphic system) and Superfile (database system). In total, it has been developed with four commercial packages related to each other:

- a) *AutoCAD*
- b) *Superfile*
- c) *DESQview*
- d) *Pascal Language*

AutoCAD is operated as the SLIMPAC Graphics program; it will display data in graphics mode. All inbuilt commands which exist in AutoCAD are being used fully. Several commands are created to make the SLIMPAC Graphics more powerful. Superfile operates as the SLIMPAC Database program; data or information can be extracted in any textual form. It provides Application programs which are not difficult for a user to understand.

DESQview is being used as a window and memory management program. All operation in SLIMPAC are controlled by DESQview. It also allows transferring data and fast access to programs; another program can be run without closing the previous program. The usage of Pascal in SLIMPAC is to write programs which operate and run the SLIMPAC program itself. It is also important for extracting data contained in Superfile for the usage in SLIMPAC Graphics (Mohd Zulkifli, 1993).

This study was undertaken to identify SLIMPAC capabilities, weaknesses and problems in information handling via SLIMPAC application areas, specifications and their operation.

SLIMPAC APPLICATION AREAS

The usage of SLIMPAC is wide. It can be applied in many aspects in fields such as surveying, engineering, architecture or administration that involves information and management. Generally, the package is used for land information management. Some of the SLIMPAC applications are:

- a) **investigation**- A user can use SLIMPAC to investigate existing information. For example, to investigate which company branch have the highest profit for a certain month and hatch it into a current map.
- b) **property terrier**- This is very useful for any person involved in land property management such as surveyors or land agents. A user can get detailed information concerning a land parcel whether from the graphical feature or textual database records. For example, area, committee responsible, valuations and charges of a certain land parcel.

- c) **proposals-** Many proposals can be tested before the plan is certified. This process could be comprehensive and automatically documented including colour maps and 3D visualisations of the site. This is useful for 3D surface modelling.
- d) **planning and analysis-** Development of a new shopping centre can be quickly planned in an existing map provided by SLIMPAC. A developer should know which type of shopping centre can be most profitable for traders and customers. As a guidance, an analysis of socio-economic factors referenced to each postcode or district will give some potential to planning. This information can be extracted from the database records.
- e) **development-** This is not very different from planning. Detailed information of land parcels for a potential development area such as site area, shapes, parcel valuations, list of owners or current planning applications can be studied. These can be immediately extracted through the database records for the proposed development area.
- f) **facilities management-** This is one of the advantages in the application of SLIMPAC. A user can use SLIMPAC facilities; map and database records to obtain the detail information of location, construction and condition of a public utility. For example, the detail information of an upstream sewer network can be obtained from a selected sewer line feature within the map or textual database records.
- g) **descriptive information query-** Another function of SLIMPAC is to provide information in descriptive or textual form. Any textual information queries can be obtained directly and independently through this facility. For example, a user can extract the sum of land parcels chosen from a certain address postcode.

SLIMPAC SPECIFICATIONS

The following are some of the SLIMPAC software specifications:

- a) SLIMPAC consists of two different types of data that are inter-related to each other; graphical and descriptive data. Graphical data are shown in a map or a drawing using AutoCAD software and the related descriptive data are shown as attribute using Superfile.
- b) Information within SLIMPAC can be searched independently or simultaneously and exchanged through its Graphics or Database programs.
- c) SLIMPAC extends AutoCAD standard commands for its graphical functions, such as the "FSET" command that is used for selecting graphical features.
- d) The SLIMPAC standard commands allows both simple and complex queries of the data. For example, information on buildings of a certain design built before a specified year with a certain value could be requested.
- e) Map information can be input from many sources and the scale, colours and symbols of the displayed map can be changed using inbuilt commands.

- f) Textual records associated with the map features displayed on the screen can be viewed simultaneously.
- g) SLIMPAC provides "HELP" facilities for any process if problems occur without referring to the instruction manual.
- h) The quantity of descriptive information and number of field records in the SLIMPAC Database program is limited only by the capacity of the computer. All descriptive data are stored only in one file.
- i) Types of descriptive data are flexible. It can be character, numerical or julian date.
- j) SLIMPAC provides commands in its Database program to look for another associated records, link models, print, change or alter the database records from a current record.

SLIMPAC OPERATION

The operations of SLIMPAC are divided into three categories; input, processing and output. Data sources are needed in SLIMPAC for input and are re-structured for processing. A user can have the information resulting from the processing stage either directly on a screen or printed out as a hard copy. Figure 1 shows the system operations in SLIMPAC.

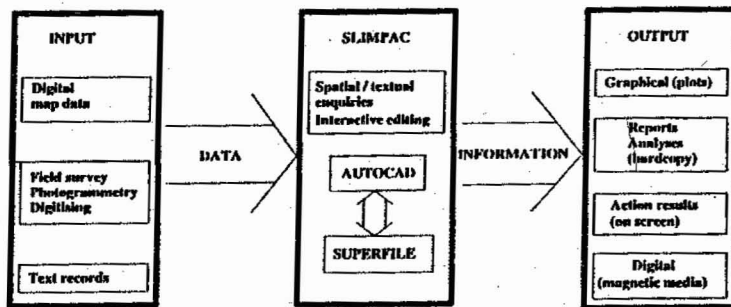


Figure 1 SLIMPAC system operation

Data sources

The capabilities of SLIMPAC in capturing data sources are not limited. SLIMPAC consists of various types of data either in digital or non-digital form. Data in digital form can be concerned with different types of data structure. It can be obtained from other computer systems; spatial data has already been formed into features and non-spatial data might already be associated with it. Many of the data sources in this category are obtained from the Ordnance Survey (OS), for example, data in Ordnance Survey Transfer Format (OSTF) and Digital Map data for Customers (DMC) format. All types of data in this form must be converted into AutoCAD Drawing eXchange Format (DXF) file format when they are to be used in SLIMPAC. The conversion programs are available in this package. For example, program OSTODXF allows a user to convert digital data from OSTF, OSTF+ and DMC file format to DXF file format.

SLIMPAC also allows a user to input data from field survey, photogrammetry or digitising. Some data provided by OS are incomplete, such as the positions of trees not being shown in the digital data form. A field survey should be carried out to find their positions on a map. Data obtained from this survey are converted to DXF file format from a data recorder (e.g. Psion) through Land Survey System (LSS) software or another supported DXF file software. Currently, conversion programs to capture data sources from photogrammetry are still under development. Another way to input data, is to directly digitise plans into the package. Interior spatial information can be obtained from architectural plans in this way. SLIMPAC has the facilities for interior information queries either from feature selection in drawings or through database records or both. To fulfil this facility the only way to obtain data sources for interior spatial information are to digitise it from some type of plan, for example, room plans and floor plans.

Other than the above method to obtain data sources, SLIMPAC also needs descriptive or textual data to fulfil its role as an integrated package in GIS applications.

Data organisation

Before any software package is developed for GIS purposes, data classifications must be defined. SLIMPAC classifies its data organisation into two categories for its applications. The categories are:

- a) graphical data and
- b) descriptive data

Graphical data

Graphical data are classified by the object or phenomena on the ground. It is referred to geographical data. Geographical data are referenced by using standard coordinate systems to locations on the earth's surface (Burrough, 1986).

SLIMPAC divide graphical data into three categories (Figure 2):

- a) Un-intelligent features
- b) Semi-intelligent features and
- c) Intelligent features

Each category is classified into different layers according to its features. A feature is "*something which is discretely defined, comprising a number of spatial and descriptive elements, treated as an indivisible set. (i.e. a set of spatial elements having a common descriptive element.) e.g. house, tree, drain*" (Hosken, 1988). A layer is a basic element of data storage; different kinds of a graphical data can be stored in different layers. The number of layers in AutoCAD is unlimited, depending on the computer storage space. This term is widely used in CAD system.

a) Un-intelligent features

The un-intelligent features are the main data sources representing surface details in layers within AutoCAD. They can represent background detail in the drawing. Any data sources can be input in this classification to fulfil the user's need. This type of feature will be used to fulfil itself as its function or for creating semi-intelligent or intelligent features.

Data sources for these features can also be obtained from the field survey, photogrammetry and digitising from another maps or plans. Un-intelligent feature categories and examples are shown in Figure 2.

b) Semi-intelligent features

Data sources for these features are adopted from the un-intelligent group. There are no descriptive or textual database records for these features in SLIMPAC. Semi-intelligent features are needed to maintain any graphical view on the screen within layers. The examples of some features are pavements, building access and steps. Figure 2 shows a level of semi-intelligent features and its examples.

c) Intelligent features

The data sources for this category are obtained from the original data sources; un-intelligent features such as OS-Water, OS-Road, new survey and others. These features are created to relate to the appropriate associated textual database records.

Intelligent features are divided into three classes:

- i) Area feature
- ii) Line feature
- iii) Point feature

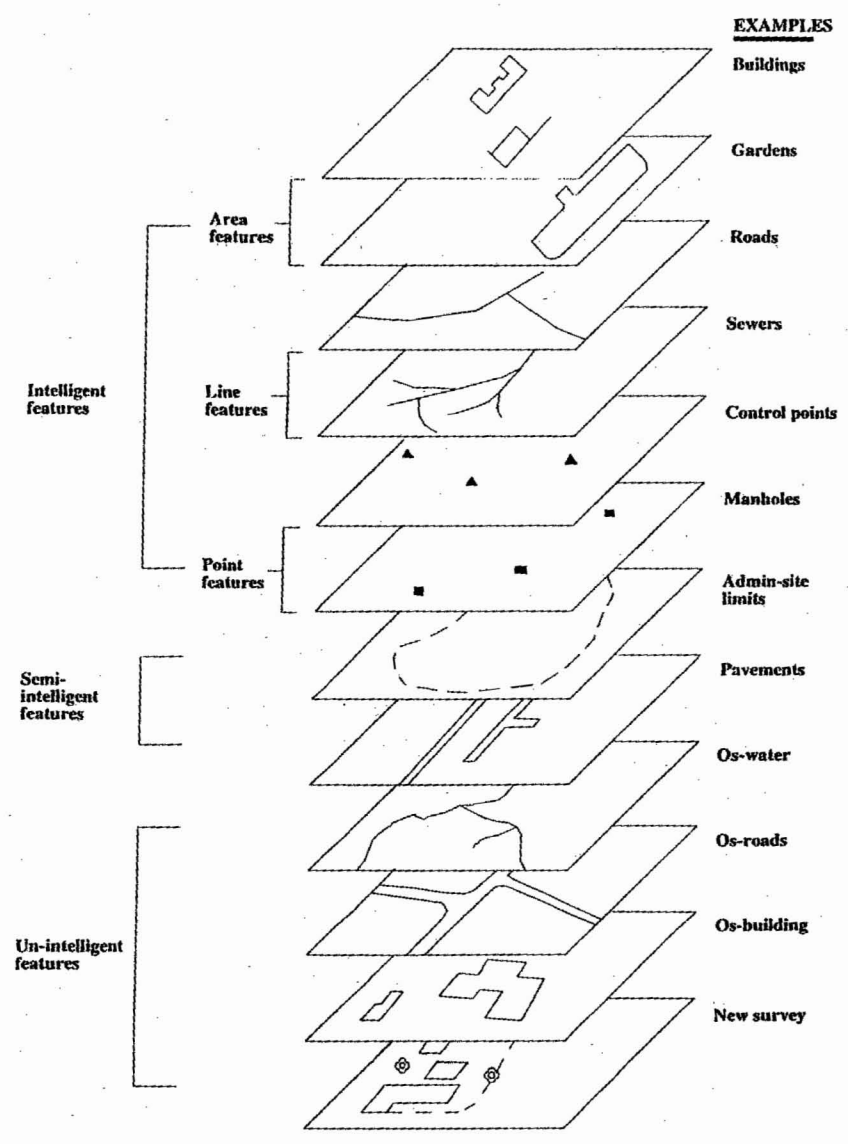


Figure 2 Graphical data categories in SLIMPAC

An area feature is defined as an entity containing series of points connected to each other to form a closed polygon. The definition of a line feature is an entity shown by series of more than one coordinate in a clockwise order. A point is an entity containing a single coordinate set either in a two dimensional (XY) or three dimensional coordinate system (XYZ). Types of data for all the above features are according to their form. For example, the data type for area features are all the area types such as buildings, car parks, etc.

These intelligent features can be created in different layers. Layers are unlimited. Every layer must be assigned a feature identity at the start of the layer name. The feature identity for area features starts with "A....." e.g. Abldg, Acarpark; for line feature starts with "L....." e.g. Lsewer, Lroad and for point feature starts with "P....." e.g. Pmanhole, Ptree. However, this identity will be combined with the feature name and automatically creates the intelligent layer name. Each feature has a SLIMPAC unique feature number, which is common to both graphical and descriptive data, and it can be cross-referenced. For example, while the graphical feature is being created, the appropriate associated textual record is then automatically being inserted into the database containing as feature number, feature name, area and centroid coordinate. It is important that the graphical feature name should be created with the same name as the form in the database. For instance, if the graphical feature name in AutoCAD is BLDG, the form name in Superfile should be BLDG. A level of intelligent features and examples are shown in Figure 2.

Details description of these important of un-intelligent, semi-intelligent and intelligent features can be referred to *Buletin Ukur, Mohd Zulkifli Mohd Yunus (1994)*.

Descriptive data

Descriptive data or non-spatial information is attribute information that is related to the graphical data; i.e. textual information for the graphical features. Superfile is a commercial database management system for storing textual information on micro computers. It is a package to store any sort of information such as feature number, name of department, address, postcode, etc.

Superfile is very adaptable. It keeps all its records in one database file. It stores any number of records. Each record can consist of any number of fields of information. Records are most easily created and edited using Forms. Superfile can have any number of types of records. Superfile accepts any record as long as it uses valid tags. It imposes no particular shape on records. A record can contain whatever tags (field names for records) a user likes. Records are easy to find, erase and add. Records containing different types of information can be linked together by common items to make a relational database. The order of records in the database tends to be random, since new or altered records are added at the physical end of the single database file. In SLIMPAC, Superfile is used to store, retrieve and manipulate all descriptive information without restrictions in a single computer file. It can be accessed via special index files.

SLIMPAC classifies its textual information into two forms:

- a) main form
- b) associated records form

Main form constitutes the important general information related to the graphical data. This form is used to link with graphical features; a main form is related to each intelligent feature. When a user chooses any graphical feature and wishes to obtain its textual information, first, this form will be displayed with the information on unique feature number, centroid coordinate, area, feature name and the detailed description of a feature. This form also provides a column to relate it to other forms called associated record forms.

Associated records form is a sub-form, continuation from the main form. Any further information considered with the graphical feature can be obtained from the main form via this associated record form. A user is allowed to create an associated record form from the previous associated form. SLIMPAC provides such commands to relate the main form to any associated record forms. However, a user should declare a total maximum number of the form used in a current project. SLIMPAC limits its maximum form in each project to fifty forms only.

Information presentation

The operation to present information in SLIMPAC is carried out by two methods:

- a) map information
- b) textual information

Map information

Presentation of map information is managed by AutoCAD. It represents graphical surface detail into different layers in different categories.

When features are selected in a map, SLIMPAC will hatch the selected features with different colours. A user can only obtain information about a SLIMPAC feature number shown on the graphics screen. If SLIMPAC holds a large spatial dataset, it is better to divide them into several sites. Each site shows a different AutoCAD map drawing, but all related textual information is held in a single database. Map information or map drawings of any area can be produced on a multi-pen plotter.

Textual information

The majority of queries made on information can be done through the database records. Using the SLIMPAC Database program facilities, a user can insert any query information into a blank form to obtain complete information for a feature.

Both information, map and textual, can be operated independently or simultaneously. A selected feature from the descriptive database either from the main form or an associated record form matching a required model can be drawn (displayed) in the SLIMPAC Graphics. The reverse process of searching the textual information describing a drawn feature from the map is also possible.

The textual information for a selected feature can be produced directly to the printer. The layout is the same as the form seen on the computer screen after a query is made using the available commands. This information can also be obtained as a hardcopy in "Reports" form style that is available using the SLIMPAC Database.

CONCLUSIONS

SLIMPAC, the Surveyors Land Information Management Package is a new tool for GIS applications. SLIMPAC is used for any operation related to information and management. It can be applied for investigation, property terrier, proposal, planning or analysis, development, descriptive information query and facilities management.

Various types of data can be input in SLIMPAC either in digital or non-digital form. All descriptive data in database records are held on a single computer. However, this will change where the current database can be held on a file server (i.e. a remote computer) and accessed from several locations. Graphical data types are classified into three categories; un-intelligent, semi-intelligent and intelligent features.

In future, SLIMPAC data will become more intelligent. The OS will provide map data with a topological structure. With careful design, all spatial and non-spatial information collected can be transferred to other more powerful systems available. Currently, an extension to SLIMPAC already permits the transfer of data (map and textual) in semi-structured from AutoCAD and Superfile to ARC/INFO GIS software which was developed by Environmental System Research Institute, Inc. (ESRI) (Parker, 1989).

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