

G.I.S For Local Authorities

Taher bin Buyong, PhD
Jabatan Geoinformatik
Fakulti Ukur dan Harta Tanah
Universiti Teknologi Malaysia

Abstract

In the advent of computer technology, GIS has been rapidly adopted by many organizations as an effective tool for managing, organizing, and analyzing spatially related data. Local authorities who are known to be dealing with spatial data for most of their daily functions will benefit greatly from GIS. This paper highlights some of the major points.

1.0 INTRODUCTION

Local authorities in Peninsular Malaysia are formed in accordance with Local Government [Act 171] Act 1976 (Zahari, 1991). the objective of local authorities is to provide services for maintaining the general cleanliness of the area of its jurisdiction so that the health of the citizens is not jeopardized.

A large percentage of decisions made by local authorities are spatial in nature: the decisions largely involve spatial objects such as land lots, buildings, roads, storm drains, planning zones, rivers, parks and night markets. The management of these spatial objects can be facilitated with the use of GIS.

This paper highlights some of the benefits from the use of a GIS by a local authority. The next two sections discuss GIS and functions of local authorities in general. The following section describes the use of GIS by some units of local authorities followed by a strategy for implementation. Conclusions to the paper are given in the last section.

2.0 GEOGRAPHIC INFORMATION SYSTEMS

A geographic information system (GIS) consists of computer hardware software and procedures designed to support the capture, management manipulation, analysis and display of geographical or spatial data.

Geographical data describes objects in the real world in terms of

- their location,
- their textual or attribute data,
- their spatial relationships, and
- the time that the above information is valid.

The fourth characteristic of GIS is still being researched and not yet available for many GIS packages and the locational data, for most GIS, is limited to two-dimensional (plane) location.

Nevertheless, GIS has found many applications because it is an effective tool for integrating the various form of data, specifically locational, textual and their spatial relationship, after which many analysis

functions can be applied in helping decision making processes. Three major categories of analysis functions offered by GIS are:

- data retrieval,
- spatial analysis, and
- spatial modelling.

and example of GIS application include

- environment- management of real properties, land records, forest resources, wild life, water resources and agricultural farm; monitoring of land erodibility, environmental quality and marine ecology,
- infrastructure - planning, management and maintenance of utilities such as road and highways, water supply, electricity, gas and telephone,
- socioeconomy - urban and regional planning; urban growth management; environmental impact assessment; emergency services such as fire, ambulance and police.

3.0 LOCAL AUTHORITIES

Local authorities are local administrative bodies which have legal power to carry out their duties within their administrative boundaries. Traditionally, duties of local authorities concern with the general cleanliness and health as well as the supply of services required by individuals in the respective areas. Among the services required include the collection of garbage, cleaning of drains, maintenance of roadways, etc.

As the nation progress, the functions of local authorities expanded. Local authorities now deals with many other activities that are distantly related to general health and cleanliness. For example, local authorities are involved in issuing of licenses for various types of businesses, factories and billboard; issuing of permits for various types of development; planning for public transportation; planning and monitoring of development; planning and managing public parks and recreations; managing drainage and rivers; approval of building plans; and planning and managing of public housing. The activities of local authorities ensure that development of the respective towns or cities are in accordance to the set policies and regulations for the benefits of general health (and cleanliness) of the citizens.

To effectively carry out their functions, local authorities have formed smaller administrative units to focus in specific activities. Typical units within a local authority include Jabatan Perancang, Jabatan Penilaian, Jabatan Taman & Rekreasi, Jabatan Kesihatan, Jabatan Pelesenan, and Jabatan Kejuruteraan.

4.0 USE OF GIS IN LOCAL AUTHORITIES

The administration and management of a local authority necessitates dealing with many geographical data such as land lots, buildings, roads, drainage, land use, hydrology, geology, planning zone, and topography. the implementation of a GIS would provide an efficient way of storing and managing the data.

A GIS would enable the management of a local authority to have access to numerous data and information at the press of a few computer keyboards. Data that once were physically scattered at various units and department are now residing in a GIS database. Information that was formally difficult and time-consuming to generate can now be obtained in a matter of seconds. In the following subsections, we briefly describe the benefits that local authorities can realized from a GIS.

4.1 Town Planning and Development Control

Jabatan Perancang can benefit from the existence of a GIS in the preparation of development plans such as structure plans, local plans and layout plans of a local authority area. Developing structure plans require geographical data such as demographic trends, surrounding developments, transportation network, socio-economic pattern, etc. These data can be made to reside in a GIS and thus, can be easily accessed during the process of structure plans development. There is no need to cross-reference various data in filing cabinets, maps hanging on walls, etc. For example, areas for heavy and high-risk industries must be located away from populated areas and on land unsuitable for other uses that would otherwise provide a much better socio-economic and environmental returns; and land allocated for residential and non-residential must be optimally balanced to benefit all parties.

the development of local and layout plans require much more detailed data such as land ownership, land value, topography, drainage pattern, hydrology, geology, road network, water supply, electricity supply, etc, of a specific location. These types of data are needed to plan for a development for a particular location. For example, if an area is planned for residential some of the pertinent questions are

- what would be the area allocated for low, medium and high cost houses;
- what is the minimum size of lots for each category of houses;
- what is the parking requirement for the commercial area;
- what is the density of the development;
- how is traffic out the area to be dispersed;
- what would be the requirements for water and electricity;
- how the drainage for the area to be solved.

The decision to be made requires various types of data can easily be accessed from a GIS.

A GIS can also be used to model the scenario if certain type of development takes place at a particular. For example, the system can be requested to determine the effect on the socio-economy, traffic pattern and environment of the surrounding areas if area bordering a particular area is to be designated as high density residential, low density residential, heavy industries or commercial area. iterative nature in the process of the preparation of local and layout plans make the use of the GIS inevitable.

the control of planning and development of a local authority can also be facilitated with the use of a GIS. Development proposals by property developers can be checked to confirm that the development proposal conform with the approved master plan. At the click of the property (land lot) representation on the computer screen, all planning relevant data with respect to the property such as zoning (residential, commercial or industrial), type of houses, density, lot sizes, and other requirements like parking, road, school, place of worship, recreation, drainage and utilities will be shown. Apart from that, public enquiries (for example counter services) with respect to these information can also be answered within seconds.

In short, given the dynamic nature of the planning and development of a city, it is important to have a reliable information system such as a GIS, which can serve as the eyes and ears of large planning process. A GIS provides for the monitoring and surveillance of compliance with planning regulations and it serves as an early warning system with regard to sources of friction, imbalances, shortfalls and failures in the process of developing of a local authority. it is also required for forecasting, modelling and evaluation of the current situation and changes that are in progress.

A GIS can also be used to expedite the preparation of working papers and reports to be submitted to various meetings at the state and federal levels. charts, graphs, tables, and maps, as the results of various

analyses, can easily be produced to be included in the papers and reports. The use of a GIS will significantly reduce the workload of the personnel preparing the papers. Further, analyses carried out by a GIS is much more reliable than the one carried out by hand.

4.2 Property Valuation and Management of Rates

The valuation of properties for property rates (cukai pintu), acquisition, development charge, etc. can be greatly facilitated with the use of a GIS.

Any desired property can be indicated on the computer screen and the system will determine the market value of the property within seconds. Without a GIS, a valuer would have to spend a lot of time finding comparable properties in the vicinity and their recent transacted values using hard copy maps and data in filing cabinets because these data are needed in the valuation process of the desired property. With a GIS, there is no need for the valuer to do so because these data are already available in the computer system and they are automatically used in the valuation of the property rates. Apart from that, views on pattern such as distribution of property rates, property ownership by race, property ownership by nationality can also be easily generated.

A local authority GIS can also be used to manage the collection of property rates. For example, complains and appeals can be attended to immediately because all data pertaining to the property are available within the system and can be accessed by pointing and clicking at the property's representation on the computer screen. The complaint can be shown why his/her property rate is higher than the neighboring properties. The higher rates could be due to alteration or improvements to the property. The system can even store photographs of the property to justify the valuation.

At any point in time, a GIS can be made to display a map showing properties that have yet to pay their property rates. This piece of information is very valuable because it shows the trend of property rates payment by citizens of a particular local authority. The GIS can also be used to construct property or land value maps from time to time with great ease. Such maps indicate, among other things, growth pattern, market preference and potentiality of areas. Such information is very useful for planner in particular, for proper planning of a city as well as for investors, for investing in the city.

Property rates is a major source of income to many local authorities. Any improvement to the management and administration of property rates could improve revenue collection which in turn could improve provisions of services to the public. A GIS definitely can help in improving the management and administration of property rates collection.

4.3 Road Maintenance and Management

The objective of having a GIS for road management is to enable more efficient and cost effective and cost effective road maintenance. The objective is based on the GIS ability to hold certain types of data and to link information accurately about particular stretches of road. This facility is better known as dynamic segmentation.

Dynamic segmentation is a new technique introduced in GIS in the late 1980's for managing linear features. This method enables attribute data to be attached to linear features using a measurement system called metric-route, which is a one dimensional measurement system that defines distance along a linear feature. The location of the linear features and their segments are free form topology and they do not have to start and end at nodes. With dynamic segmentation, data along stretches of roads such as

- pavement data (types of pavement, date paved, etc.),

- accident data (type of accident, number of vehicles involved, data of accident, number of casualties, etc.),
- traffic flow data (volume of traffic, time of the day, etc.), and
- road inventory data (bridges, bus stops, pedestrian crossing, overhead crossing, traffic lights, etc) could easily be managed.

4.4 Others

The benefits of a GIS to the management of local authorities are too numerous to be listed here. For example, the system can be used to show optimum route to move from one point to the other (such as when transporting VIPs or dangerous goods); optimum route for pick-up and delivery services such as garbage collections; environmental monitoring such as noise levels and soil erodibility; and transportation management and planning; Figure 1 shows some of the geographical data residing in a GIS that would be required for the execution of each of the operations.

	Land Ownership	Landuse/Zoning	Property Valuation	Road	Building	Drainage	LRT	River/Lake	Topography	Demography	Household Income	School	Hospital	Recreational Area	Place of Worship	Parking	Utilities	Night Market
Preparation of Structure Plans	•	•	•	•	•	•	•		•	•		•	•	•	•	•	•	
Road Excavation Management				•													•	
Housing Requirements Analysis		•	•	•						•		•	•	•	•	•	•	
Development Controls		•		•	•	•		•	•	•		•	•	•	•	•	•	
Business Premise License	•	•		•	•											•	•	
Property Valuation	•	•		•	•	•	•		•			•	•	•	•		•	
Vehicle Routing (for VIPs, Emergency Services, etc.)				•	•													
Soil Erodibility/Slope Stability						•		•	•									
Facilities Siting Studies	•	•	•	•	•	•	•		•	•	•	•	•	•	•	•	•	
Hawkers Management				•	•													•
Bus Routes Planning		•		•	•		•			•	•	•	•	•	•	•		
General Information & Enquiries (for General Public and Policy Makers)	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•

Figure 1: Examples of operations and types of data needed

5.0 STRATEGY FOR IMPLEMENTATION

A GIS facility cannot be bought off the shelf. It is rather an assemblage of various items of equipments that can become a useful tool only when it is placed in an environment properly supported by appropriate personnel, data and organizational routines (Bernhardsen, 1992).

Officials in local authorities who are interested in implementing a GIS have several tasks ahead of them to ensure success of the system. First, they have to convince the decision makers to provide funds for the project, and second, they will have to manage the project and deliver the products. The difficulty of the tasks depends largely on the complexity of the envisioned GIS system.

The issues associated with justifying and managing a GIS project can be generalized in three main categories (Huxhold, 1991):

- evaluating GIS needs - A complete understanding of how a local authority uses geographic information in performing its various functions is necessary in order to identify potential benefits of a GIS and ensure that its use will be consistent with the developed short and long term goals of the local authority.
- gaining organizational support - It is necessary to demonstrate that the benefits of using a GIS will be greater than the cost of implementing and maintaining the system. This can be accomplished by performing cost/benefit analysis and further proven by a pilot project.
- managing the project - Different applications and related digital data must be developed. Appropriate personnel and organizational support structures to ensure the successful operations of the GIS must be assembled.

For local authorities that are short of funding, it is a good strategy to start with

- applications that contribute a major portion of the local authority's revenue, and
- a PC-based system and move to a higher end system at a later stage.

This implementation strategy allows minimum up-front investment with immediate returns. However, the economic principle that return is proportional to investment must be weighted carefully.

6.0 CONCLUSIONS

A GIS is a computerized information system that efficiently deals with geographic objects. Since the management of local authorities necessitates dealing with many geographical objects, GIS has been shown to benefit the management of local authorities.

One of the major tasks facing local authorities in implementing a GIS is finding funds for the project. Decision makers are still skeptical about the benefits of a GIS for local authorities and thus reluctant to allocate relatively big budget necessary for GIS projects. An implementation strategy must be found soon so that local authorities can realize the benefits from this technology.

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About the author

Dr. Taher Buyong is an Associate Professor in GIS at the Department of Geoinformatics, Faculty of Surveying, UTM. He graduated in surveying from the University of New Brunswick in 1981 and University of Calgary, Canada in 1985. In 1992 he received a PhD degree in GIS from University of Maine, Orono, United States and became a Director of Center for Geographic Information and Analysis (CGIA), Universiti Teknologi Malaysia. His research interests comprises several aspect of GIS/LIS.