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RESEARCH ARTICLE **ENGINEERING TECHNOLOGY**

IMPROVING HOLDING TAX ASSESSMENT – A CASE STUDY OF NIRALA RESIDENTIAL AREA, KHULNA

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Abstract: This study presents the development of a land information system for a residential area in Khulna city of Bangladesh. The system is designed to provide the Municipal Corporation an ability to assess the holding tax in an automated GIS based application, which can also assist to trace out tax delinquency and tax defaulters. This study demonstrates a case study of a database system which can be easily maintained, queried and updated than the current hard copy database. This system can be practiced by other City Corporation and Municipality in Bangladesh for raising their internal revenue income.

Key words: LIS, GIS, holding tax, automated

Introduction

Rapid urbanization is one of the major challenges of the world. In 2005, the world's urban population was 3.17 billion out of a world total of 6.45 billion. Current trends predict that the number of urban dwellers will keep rising, reaching almost 5 billion by 2030 out of a world total of 8.1 billion (Anon, 2007). As a result planned development of towns, cities and metropolises has become a nightmare for those who are burdened with this responsibility. To meet these emerging planning challenges, an updated and automated city management system is essential to serve increasing citizens with limited resources. The age-old manual and paper based information of land in developing countries makes it extremely difficult for planners to manage development activities and make comprehensive decisions comprising all factors and prevailing constraints. To make the city livable and manageable, it is essential to introduce an automated Land Information System (LIS), which can aid a time-worthy solution and its application. LIS is defined as the combination of human and technical resources, together with a set of organizing procedures that produces information on land in support of a broad range of managerial requirements (Mclaughlin and Dake, 1988). A GIS based LIS represents a system for handling spatial data related to multivariate and multilevel data and attributes concerning topography and cultural imprint on it as well as revenue collection, land and property ownership, environmental parameters, utilities and services, socio-economic information, and infrastructure data that helps planners and administrators to carry out their jobs. It is designed to accept a large volume of data derived from variety of sources including remote sensors and to efficiently store, retrieve, manipulate, analyze

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and display this data according to user specification and in user desired format in real time (Agarwal, 1987). Holding tax is a vital source of income for the cities in developing countries. Determination of tax on a property requires truthful information about the property structure, location, ownership, condition, size, and its use which are accessible in LIS. Taxation system needs inventory of land parcels that provides the information necessary to determine the value of each parcels and the tax. Existing system at the metropolitan cities in Bangladesh reveals that traditional methods are being followed and tax is being calculated manually. There are strong possibilities and practices to assess holding tax according to desires of the tax payer, not following the laws of taxation, which gives a way to many possibilities for unlawful tasks like corruption and tax defaulting (Hassan and Saeed, 2004). In this study, GIS based LIS application is used for tax assessment in municipality in place of an existing paper based land recording system. This study encompasses the computerization of property tax assessment records, property enumeration, creation of property maps and generation of attribute data from survey records and integration to individual property maps. It is designed to automatically calculate the tax due on a property by just putting raw data. The system has also capability to generate tax recovery information when required so as to keep a check on tax defaulters. Further, it provides opportunities to perform various analyses on the spatial data and attribute data to provide a base for decision making and future planning.

In this study, assessment is carried out in the Nirala residential area of Khulna city. Khulna City Corporation (KCC) recovers its expenditure by delivery of services and by imposing holding taxes. According to annual budget of KCC (2003)[†], the number of tax-paying holding units are 40,640. KCC uses a paper based recording system for those tax-paying holding units. This type of manual system is very difficult for inquiry and quick assessment of holding tax. Holding tax covers 60% of KCC's total income. A large number of employees of the Revenue Department of Taxation Cell are engaged to regulate, assess, enforce and collect holding taxes. Despite of all efforts made for the collection of holding taxes, the income of KCC comes only about 12% of the total budget of the financial year 2003-2004[1]. The primitive existing taxation system practiced by KCC is largely responsible for this poor recovery rate of holding tax. In the present system, assessment section is unable to cope with the rapid growth of holding units. It is not easy to query and update in current ledger based hard copy database as well. The assessment process is very long ranged and it is not capable to identify a tax defaulter. This study aims to minimize these shortcomings of manual system through the application of GIS.

Materials and Methods

Study area: Nirala residential area is located in the South-west part of the Khulna city about two kilometers away from CBD area. It is a planned residential area having an area of 67.31 acre, which was developed by the Khulna Development Authority (KDA) during 1980 under a sites and services scheme. The area contains 544 plots of different sizes (Fig. 1) (Swapan, 2001).

Data collection: GIS is concerned with both spatial and aspatial or attribute data and give excellent output through making a relationship with them. The study requires a large amount of spatial data and related attribute data. Spatial data were collected from secondary sources (KDA and KCC) and a census survey was conducted in the study area for the collection of attribute data. Spatial data are geographic features having particular geo-position. It represents the geographic

[†] Collected from KCC's budget documents

location and shape of features. The objects in a spatial database are representation of real-world entities associated with attributes. Most of the spatial data was collected as hard copy map sheet.

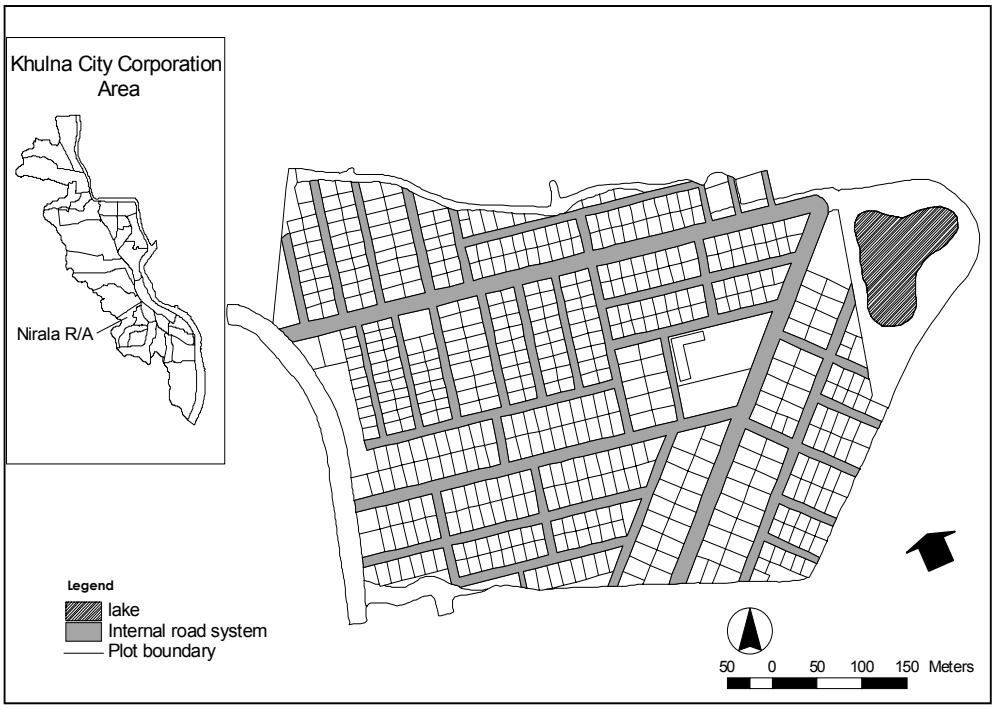

Fig. 1 Layout plan of Nirala R/A.

The data, which have no physical or geographical position on earth, is called aspatial or attribute data. This phenomenon is reported as the population, socio-economic condition of the inhabitants. In this study, 209 structures were surveyed to gather attribute data.

Table 1: Characteristics of spatial and asptial data applied in this study.

Spatial Data	Aspatial data
Topo Map (structures, floor area)	Land Use
Layout map of Nirala R/A (parcel boundary, holding number)	Status of utility and services in the plot
Road Map	Structure type and ownership information
	Prescribed holding tax

GIS analysis: For GIS analysis both geographic and attribute data has been converted to digital format using ArcView 3.2a. Digital maps were then rectified, built topology labeled and projected using ARC/INFO version 3.5.1. Attribute data such as land use, structure ownership information, plot ownership information, building information and holding tax were converted into digital format using ARC/INFO and Microsoft Excel. Spatial and aspatial data has been linked through the TABLE module of ARC/INFO. The data were stored in AAT (Arc Attribute Table) and PAT (Polygon Attribute Table) files.

Holding tax assessment process: Holding tax comprises of one tax and three rates. These three rates are water, street lighting and conservancy services. The whole process of tax assessment is based on the annual value of the building calculated from monthly rents. In case of owner occupancy similar type rented building in the locality is taken for the assessment. Municipal Corporations (Taxation) Rules 1986 was also followed to determine the holding tax of a particular building.

Results

Plot characteristics of Nirala R/A: The total land area of Nirala R\A is 67.31 acre and total population living in this residential area is 2598 (Hossen, 2002). The gross density of Nirala Residential Area is 38.59 persons per acre and the net population density is 55.74 persons per acre. In Nirala 63.085% of land is occupied by residential plots. Among 544 plots, 56 are 7.5 katha, 121 plots are 5 katha, 293 plots are 3.91-3 katha and 44 plots are irregular in shape (Swapan, 2001). There are 307 houses having a gross and net residential density 4.56 and 13.17 per acre respectively (Hossen, 2002). Survey data shows that 42% of the structures are one storied, 29% are two storied and the rest are three to five storied buildings. Another important factor for the assessment of tax is occupancy type in the buildings. It was found that 56 buildings are occupied by the owners themselves whereas 73 are rented and the remaining 83 buildings are occupied by both categories. Monthly rental value of different flats within a building varies for different aspects. Fig.1 shows that rent value of most of the buildings ranges from BDT 2000-3000.

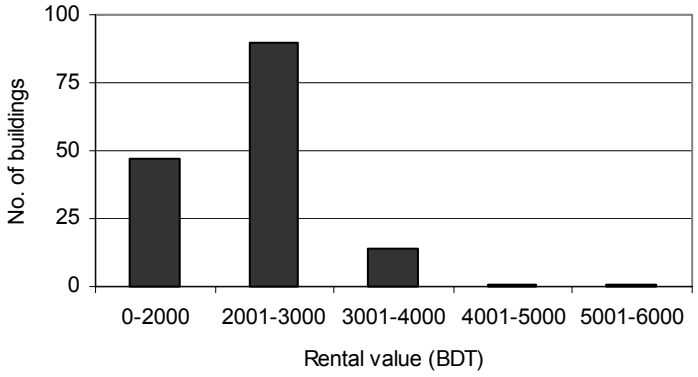

Fig.1 Rental value of buildings in Nirala R/A.

Valuation of holding tax: Municipality has assessors who prepare a valuation list of all the buildings within its administrative boundary and determines the annual value for each building using this list. The process of taxation is guided by the Municipal Corporations (Taxation) Rules 1986 and model tax schedule for detail administration of these taxes. The model tax schedule provides the maximum rate that can be imposed for each of the rates and the house tax. The following paragraphs describe the rate of holding tax prescribed by the KCC for different types of buildings.

a) ***Rented building****:* The annual value of tax is equal to the gross annual rental value minus two months' rent as maintenance allowance, and if the property is mortgaged to the Government, Bangladesh House Building Finance Corporation (BHBFC), scheduled banks or any other

financial institutions under registered instrument for securing funds for construction or purchase of the same, then the annual interest payable on account of such mortgage debt shall also be deducted. Again, if the monthly rental value of any building appears to be abnormally high or usually low, the assessor, while determining annual value, may consider that value, which buildings and lands of similar description and with similar advantages in the locality may be let out. So, the assessment is made in the following manner (Rahaman, 1989):

- Yearly rental income is estimated;
- Two months rent income is deducted for helping the owner to cover maintenance cost;
- Annual mortgage interest associated with the parcel is deducted. Loans received from any officials recognized institutions (banks) are considered in the case;
- Holding tax for rented building is:
  Annual Value (AV) = (Monthly rent X 12) - Two months rent (as maintenance cost)
  Net holding Tax = AV X 15%
  Here, 15% represents that the rate of Holding Tax estimated on the annual value in the KCC area.

b) Owner occupied buildings: The annual value of tax is equal to the probable annual rent at which the buildings and lands of similar description and with similar advantages in the locality may be let out or at 7 percent of the value of the building on the date of assessment plus ground rent for the land comprised in the building, which is less, minus the followings:

- two months rent, or one-sixth of the annual value, as the case may be, as the maintenance allowance;
- 40% of the annual value after deduction of the amount mentioned in item
- if the property is mortgaged to the government, HBFC, scheduled bank or any other financial institution for securing funds for its construction or purchase of the same, then the annual interest payable on such mortgaged debt.

*c) **Rented and partly occupied buildings**:* The annual value of the rented portion shall be calculated in the manner as specified in clause (a) and that of the occupied portion as in clause (b). So, the holding tax for rented and partly occupied building is:

Annual value (AV) = (Monthly rent X12)-Two months rent (as maintenance cost)
Net holding Tax = (25% X AV) X 15%

Calculation of holding tax using GIS: ArcView 3.2a software was used for the calculation of the holding tax for different type of occupancy. For the calculation of annual value of rented building the following steps were applied in Arcview 3.2a software:

- First, QUERY BUILDER tool was used to select the buildings which are rented building.
- In the FIELD CALCULATOR tool the monthly rent for each building and the number of flats/units were multiplied to get the annual rent for the building.
- Using the FIELD CALCULATOR tool, two months' rent was deducted as maintenance cost of the buildings. The result of this calculation is the annual value for each building.
- As the percentages of holding tax on annual value are 15%, the annual value is then multiplied to the 0.15 in the FIELD CALCULATOR tool**.**
- To calculate the structure which has owner occupancy, the selection was to make for the similar types of rented building in the same locality. The rent of this similar types of building was stored in the rent field for owner occupied building. In addition to the previous steps followed for rented buildings, FIELD CALCULATOR tool was used to calculate two months' rent and 40% of the annual value was deducted. The result of this calculation is the annual value for each building.
- As the percentages of holding tax on annual value are 15% on the annual value, the annual value is then multiplied to the 0.15 in the FIELD CALCULATOR tool**.**

For the calculation of annual value of rented and partly owner occupied building the previous steps were applied again. All the computations were assembled in ArcView shape file. Due to higher rent, some computation resulted in higher value. To reduce the abnormality, the tax value of those buildings and lands of similar description and with similar advantages in the locality were taken into consideration and normalize the high tax value. After refinement, the value of lowest holding tax was assessed as BDT 325 and maximum value of holding tax was found BDT 13,500 for a five storied building (Table 2 and Fig. 3).

Table 2. Holding tax of the residential buildings in Nirala R/A.

Holding tax (in BDT)	No. of Building	Percentage
315-1913	35	16.7
1913-3450	85	40.7
3450-5700	48	23.0
5700-9000	27	12.9
9000-13500	14	6.7
Total	209	100.0

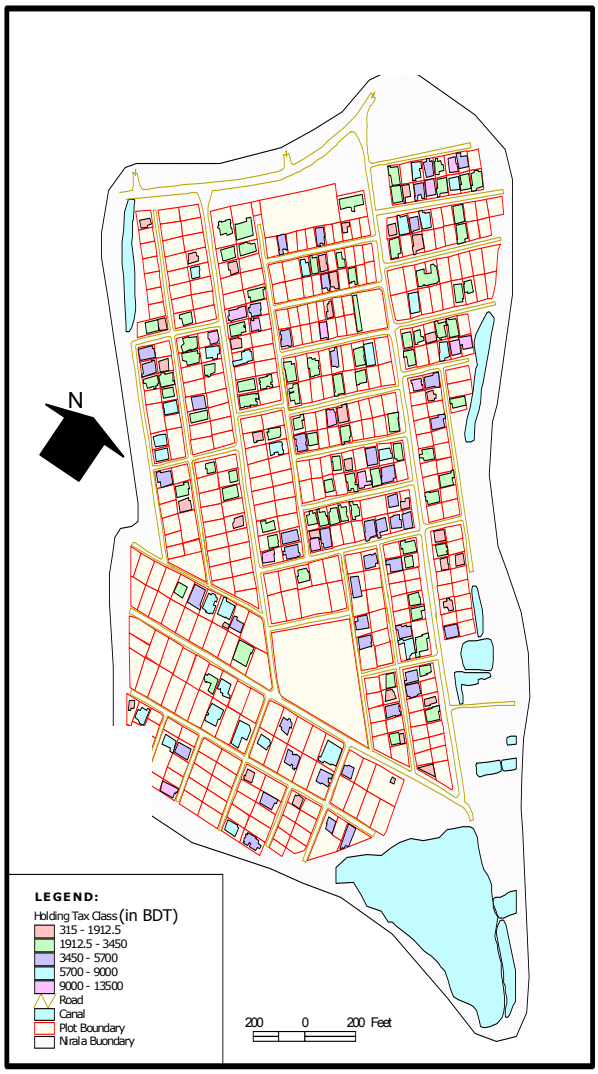

Fig. 3 Estimated annual holding tax for residential buildings in Nirala R/A

From the above findings, it is clear that GIS can be applied to automate the landuse and building information in City Corporation's jurisdiction. Once multi-layer information (e.g., landuse, location of buildings, no. of units, owners' data, renting status) are loaded in the GIS software, it is very easy to calculate the tax for particular buildings using the above methods within a minute. GIS database can be handled by trained staff of the organization as well as it can be made accessible to the citizen using simplified user-interface with the ArcView software. It can be published on website where citizen can calculate their tax providing their owner ID or plot ID. The calculation procedure described in the previous sections will run in background for direct GIS environment, simplified interface and web-based GIS interface. This system is subject to easy and frequent update which is not possible in a paper-based system. In this process clients can get holding related information very quickly and also can collect print of their tax assessment and spatial guidelines.

Discussions

For decades, the ownership and property tax data sets were recorded on thousands of paper maps (Anon, 2002). The Government Institutions like Khulna City Corporation (KCC) and Khulna Development Authority (KDA) in Khulna city are still dependent on the age-old methods of creating and maintaining land records on paper. This system of manual surveys, cloth bound cadastral maps, non-uniform structures of record of rights, hard copy register, lack of dedicated and qualified people who can maintain and update these records can not meet the user demands. GIS based LIS promotes the effective use of geographic data and geographic information technology, to benefit the people and service providers quickly. It is also possible to edit, maintain, rectify and keep the record up-to-date with least efforts. So citizens can asses their holding tax from their home desktop using GIS enabled user interface. Numerous County departments and other regional organizations in the United States as well as neighboring India (e.g., Bangalore City Corporation) have started implementing GIS in property tax assessment (Anon, 2001). Log Angeles County Council (USA) services acquired ArcIMS (integrated with ArcGIS, ArcSDE, and ArcView 3.2) with the goal of providing data more easily to the public via the Inter-net. The system is on-site providing production needs, and the other is off-site providing Web applications. Same application is also followed by Clark County Council at Washington (Fig. 4).

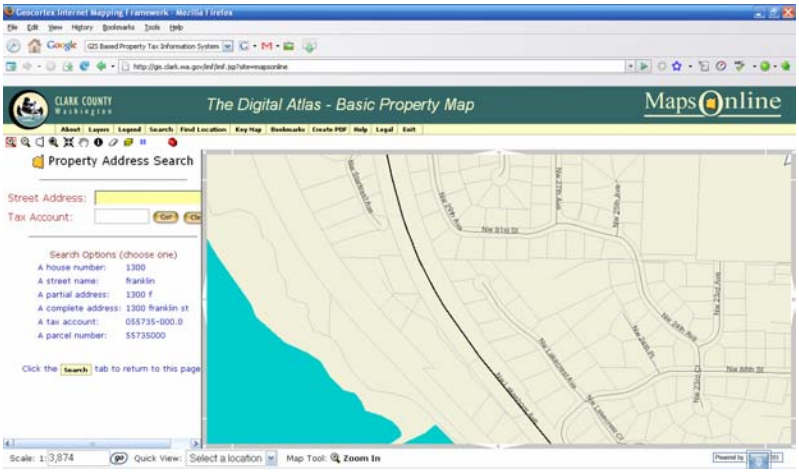

Fig. 4 GIS based web browser used for citizens under Clark City Council (USA) (Anon, 2008)

The Assessor's system is called the Property Assessment Information System. Users access it through a standard Web browser to research assessment information for individual parcels, calculate holding tax, print Assessor's maps, and search for sales within the past two years (Anon, 2002; Anon, 2008‡).

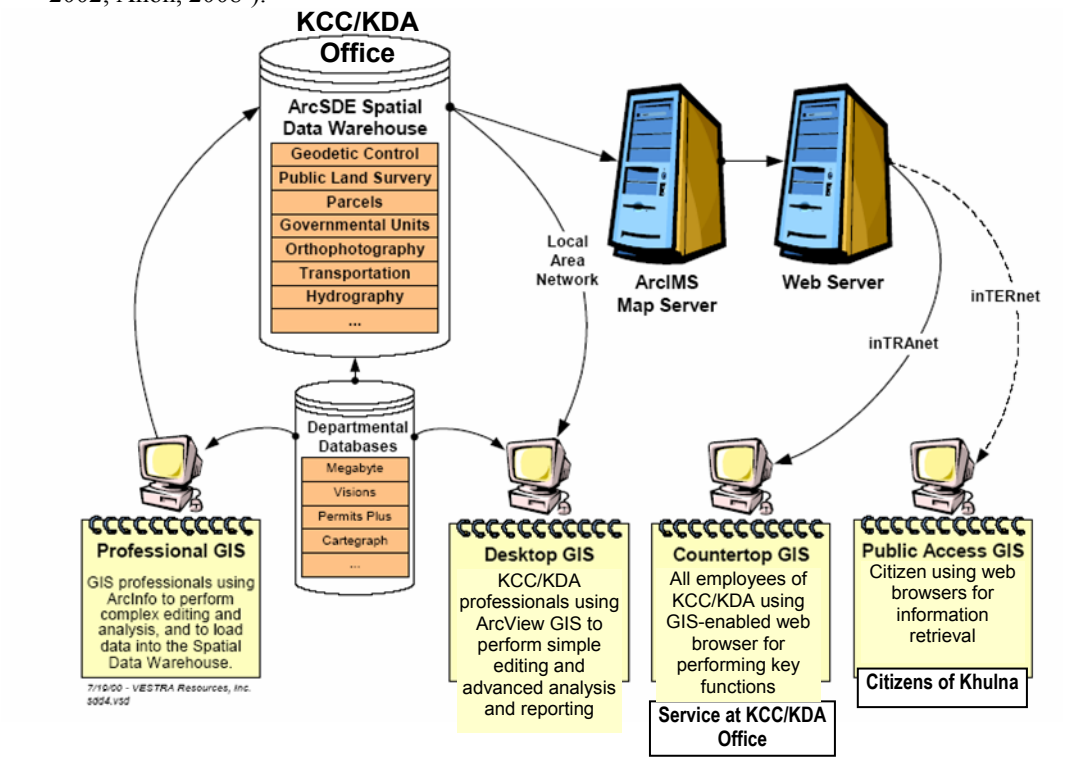

Fig. 5 Framework for GIS implementation in LIS of KCC/KDA (modified from Anon, 2001)

GIS implementation in the functions of city development authorities (e.g., KCC or KDA) requires more than just a procurement of computer hardware and software technology. Effective implementation usually requires some changes in business processes, database development and maintenance procedures, and skill levels of professional and technical staff. Fig. 5 describes a simplified framework for integrated and automated LIS that can be introduced in KCC/KDA. Local governments that have been most successful at incorporating GIS into their day-to-day activities have actually taken more of an evolutionary (as opposed to a revolutionary) approach to implementing GIS. There are two primary roles that need to be addressed for efficient coordination of GIS effort: 1) a structure within local government for ensuring effective implementation of GIS to meet the County's business needs, and 2) a forum to encourage collaboration and partnerships.

‡ http://gis.clark.wa.gov/imf/imf.jsp?site=mapsonline (accessed on April 30, 2008)

Conclusion

Revenue management is the key to economic stability and development of urban infrastructure. In order to discharge its function properly and cater to the requirements of economic development, city corporations and municipalities have to generate adequate financial resources. In the present world, the advent of computers, information technology has become as crucial for revenue management as in other shapes of life. The application showed in this study is able to design a central database for taxation system in a panned residential area. Though it is small area but this design provide the ability to query and maintain both spatial and aspatial data for the assessment of holding tax. It is now possible for the first time to track all kinds of defaulters on payment of taxes due. This will assist the city corporations in acting quickly and well in time and is expected to have a very positive impact on the total revenue collection.

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