

# Application of electronic Atlas for land management in Hanoi

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**Abstract.** Management of land is one of the very important tasks and a challenge for governments at all levels. In order to do a good land management work, many different instruments are needed, including maps.

Presently, cadastral, land use and land use planning maps provide necessary land information for different users. These information need to be uploaded on the Internet to facilitate their access and use. In order to support this task, the establishment of websites and electronic maps on land information is necessary. Electronic atlas with ability of storing data in digital format, managing data by a database management system will allow to rapidly execute the data for determination of geographical coordinates, distance, perimeter, land cell area and other necessary information. The distribution of electronic atlas on internet also allows the access and search of the objects with given parameters.

This article addresses the use of cartography, GIS and Multimedia technologies to establish the electronic atlas supporting land management in Hanoi. It is the experiments of establishing and uploading electronic atlas to Web. The Atlas with information on land administration, land use and land use planning at district level is a useful instrument for the use and management of land by citizen and land management organizations.

*Keywords:* Electronic Atlas, land management, GIS- Geography information system, database.

## 1. Introduction

### 1.1. Expanded Hanoi faces challenges in land management

In 2008, Hanoi city has been expanded its administrative borders. This is an inevitable result of the city's geographic limitation in

terms of population growth and urban structure development. The expansion of Hanoi will provide a comprehensive and full potential development environment for its own development. The increase in 3 times in area and population also enlarges Hanoi internal market and creates motivation for further development of Hanoi in the future. Furthermore, the expansion of Hanoi will also reduce unnecessary pressures from overloading

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of infrastructure, roads, lacking of lands in urbanization process, and pressure from surrounding provinces to Hanoi, especially if the industrial zones are not placed in a suitable location. By expanding, Hanoi will have advantage to relocate industrial zones to sites with suitable environment and landscape. Moreover, by reducing pressure on land prices, investment environment will be more competitive due to the reducing cost in land investment.

However, after the borders have been expanded, Hanoi will also encounter many difficulties in managing and operating its political, economic, cultural and social system. In organizational structure, Hanoi also has to face with a new, larger and more complex system both in scale and level.

With a relatively large area of 3.324,92 km<sup>2</sup> [1], Hanoi will have great difficulties in land management. That is why the construction of an Electronic Atlas supporting land management in Hanoi city is a practical task, which can solve some critical problems in managing Hanoi's land today.

### *1.2. Objectives for building an Electronic Atlas for Hanoi land management*

Together with the electronic maps, the electronic atlas is being developed in many countries in the world and refined many types and forms such as: [2],[4] Atlas CD-Rom running on a PC or Atlas on the LAN, WAN and Internet. This is one of the applications rapidly developed and has shown its advantage when internet access speed has been ameliorated.

The Electronic Atlas for Hanoi land management is built to meet the following objectives:

- + Representing all information on cadastral, current land use and land use planning of Hanoi at 3-level: City, Districts, Communes and Town.

- + Providing tools to facilitate quick information search

- + Supporting format for use on computers and on the networks (LAN and WAN) of the Hanoi city.

- + Offering data that can be downloaded, manipulated, and mapped to facilitate decision-making process.

## **2. Building the electronics Atlas for land management in Hanoi**

### *2.1. Atlas's structure*

Electronic Atlas for land management in Hanoi is structured as following: It consists of three themes including cadastral, land use and land use planning. Each theme has one map for all Hanoi city and 30 maps for every district. These maps are managed by administration unit and by theme. Maps are noted with text document, image, picture and brief description of communes and districts.

The Atlas has two main pages:

- Home page: is introduction page with the name of Atlas, use interface and the main link to the content of atlas.

- Map page: in content page showing maps and tools for manipulating function.

From these main pages, the Atlas allows to open different windows such as map window, legend window, window for multimedia elements and search information...

The Atlas is built on an open architecture; manager can add or reduce subjects, maps or update maps database regularly.

## 2.2. Atlas building diagram

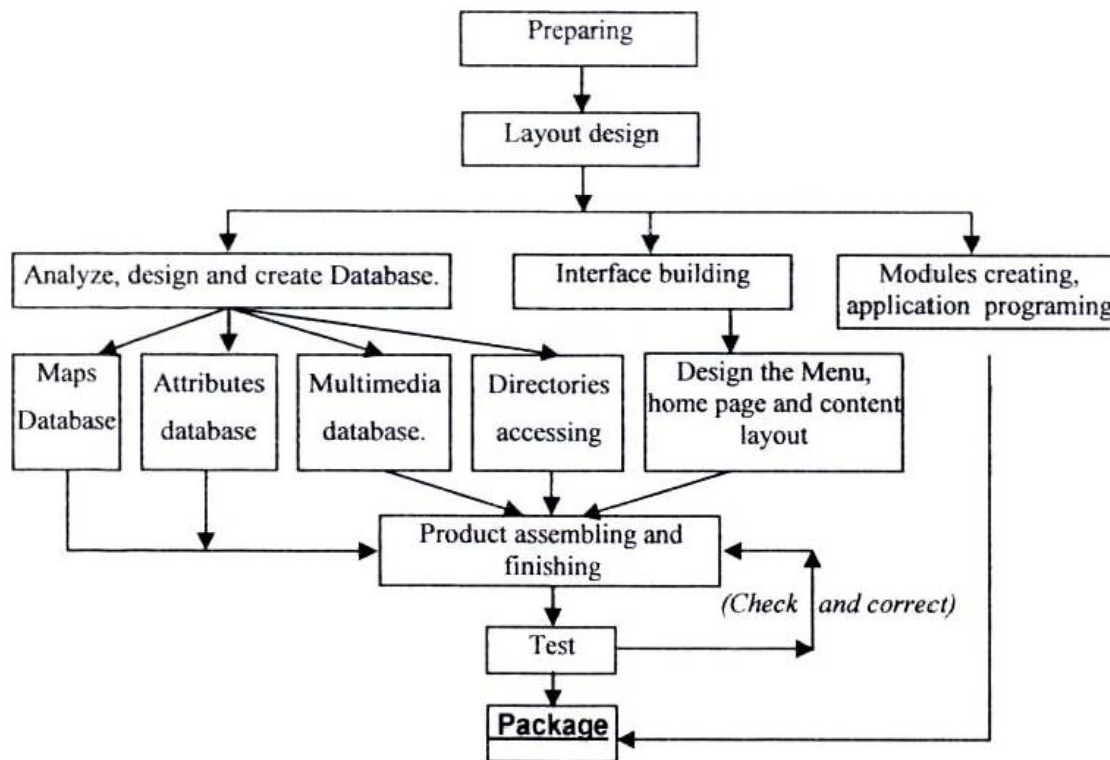


Fig. 1. Building Diagram of Atlas.

## 2.3. Map database for land management in Hanoi

Hanoi Electronic Atlas includes 3 map themes: cadastral, current land use and land use planning of all administrative units of the city. All maps are edited by MapInfo software following the guidance on mapping technology and land database system of Ministry of Natural Resources and Environment, Viet Nam.

All the maps are edited and stored in a standard format and structured before imported into the Atlas's database, for example, each map is stored in 1 folder. In each folder contains:

+ The map files ". Tab" (classes of maps), accompanied by the configuration file of each class (.map, .id, .dat, .dbf).

+ One workspace file formatted as \*. mws file and the name for all the map is bando.mws

The diagram of data storage in the Atlas is shown in Fig. 2, in which:

- Data (the folder name to store the group map data file and other attached documents)
- T: the directory for store city level data
- Huyen1, Huyen2 ... Huyen29: Folder contains district level data.
- X1, X2 ... Xi: Folder contains data of communes.
- CD1 (Cadastral maps).
- CD2 (Current land use maps)
- CD3 (Land use planning maps)

## 2.4. Building the modules of Atlas

We use MapXtreme 2005 package from MapInfo Corp. to built pages in Atlas. In MapXtreme 2005 desktop, there are various templates, which help automatically configure

and build map environment with the control tools and templates with drag / drop function. On the PC, MapXtreme 2005 fully supports several languages such as: Microsoft.NET framework with Visual Basic.NET, C #. In web

environment, this program provides a rapid deployment by providing the template map, multi-function control tools, the application samples and drag/ drop functions. It accepts all languages in dot NET framework.

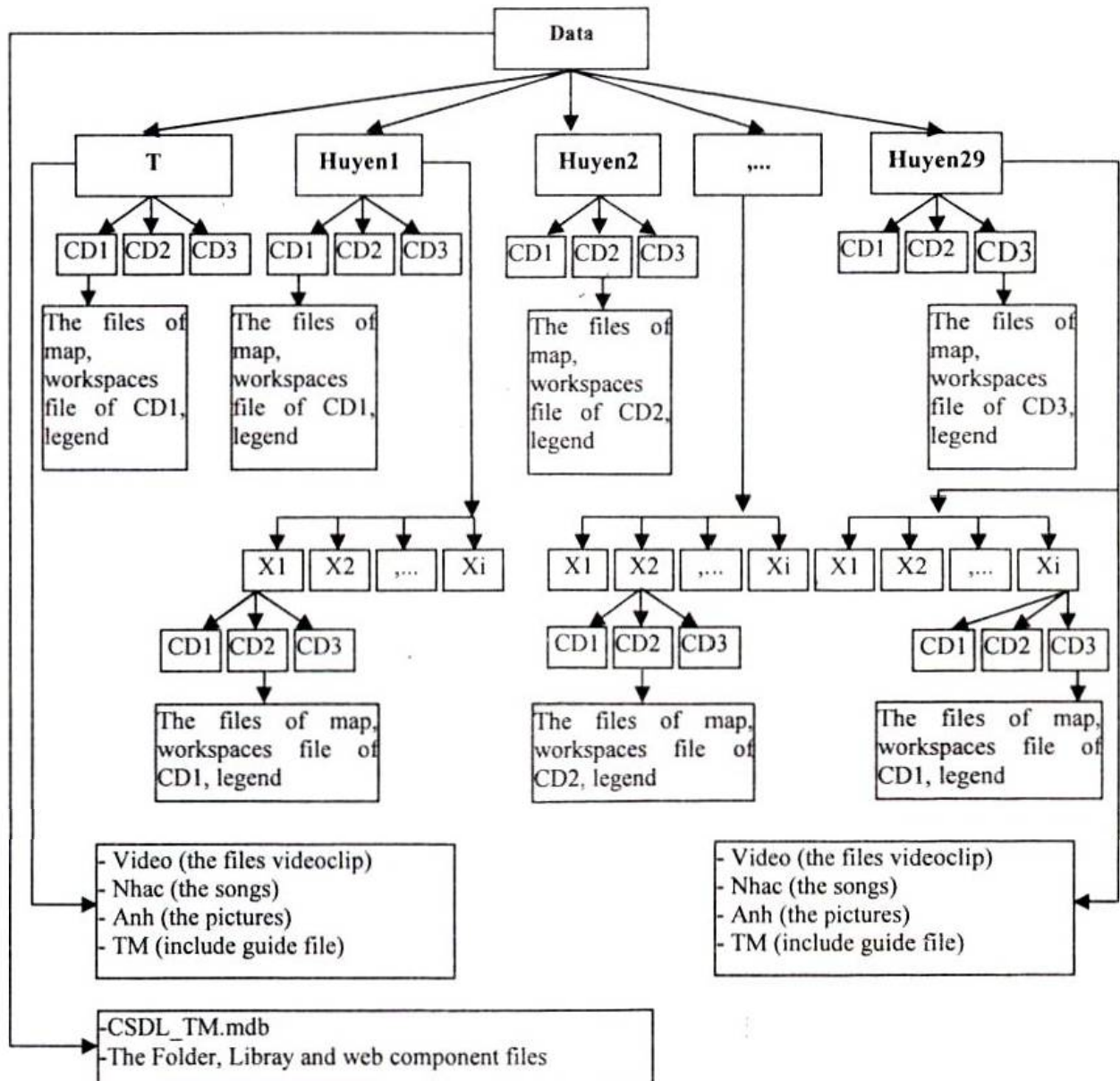


Fig. 2. The diagram of data storage in the Atlas.

2.4.1. Designing the map's content layout

During the interface design and code writing for the map's content layout, we used MapXtreme language because of its flexible ability and conveniences in use. Coding system of the content layout is built to include the

following contents: The source declaration (Page Language, code file, Inherits), declaration of the registration for using control modules in Mapxtreme MapInfo.WebControl '(Assembly, Namespace, Tag Prefix), declaration of the function to show the map (MapControl, ID,

Width, Height, Map Alias), declaration of the function to display the map layers (Layer Control, ID = "LayerControl1, Map Control ID)

2.4.2. User Interface Tool

In order to operate and use the maps system in the Atlas efficiently, we have designed a system of tools to control and manipulate the map include: Zoom In, Zoom out, Pan, Distance, View information, center Map, Layer Control, Open Legend, Find information, map Print, Refresh and help. (View in 2.5.3).

2.5. Result of test on PC

The tests we have implemented on personal computers showed that Hanoi's Electronic Atlas for land management runs stably. Atlas can be regarded as a GIS software which can be used on personal computers (PC), or LAN, WAN. This package allows the storage and management of electronic maps which contain cadastral information and information on current land use and land use planning in Hanoi city.

2.5.1. Interface of home page

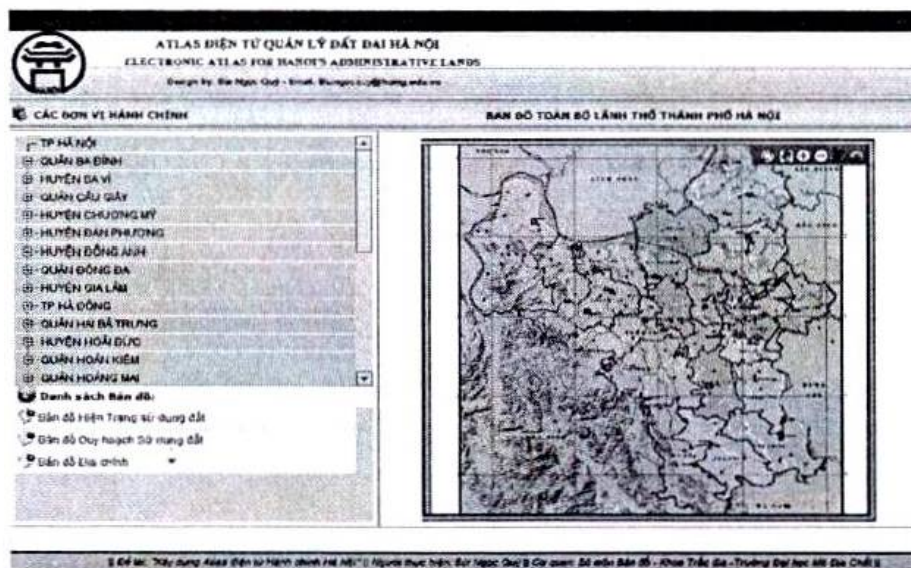


Fig. 3. Home page.

2.5.2. Tools to control and manipulate the map of Atlas

In the Electronic Atlas of Hanoi, tools to control and manipulate the map are built as a set of tools as shown below:

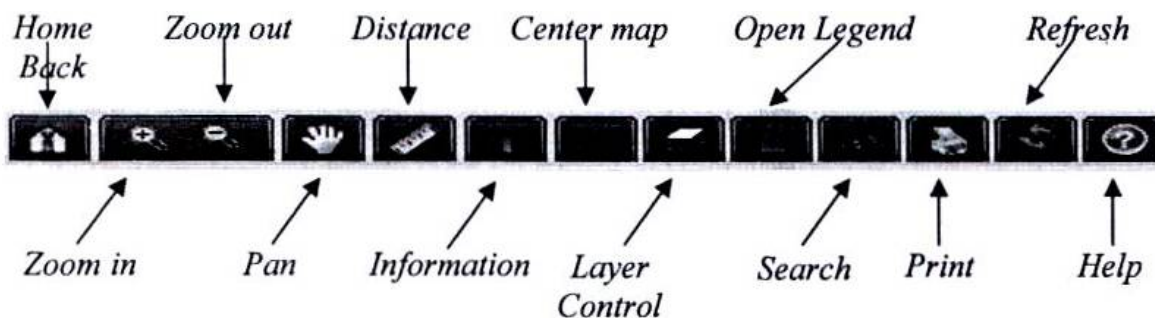


Fig. 4. Controlling and manipulating tools in Atlas.

2.5.3. Map Interface

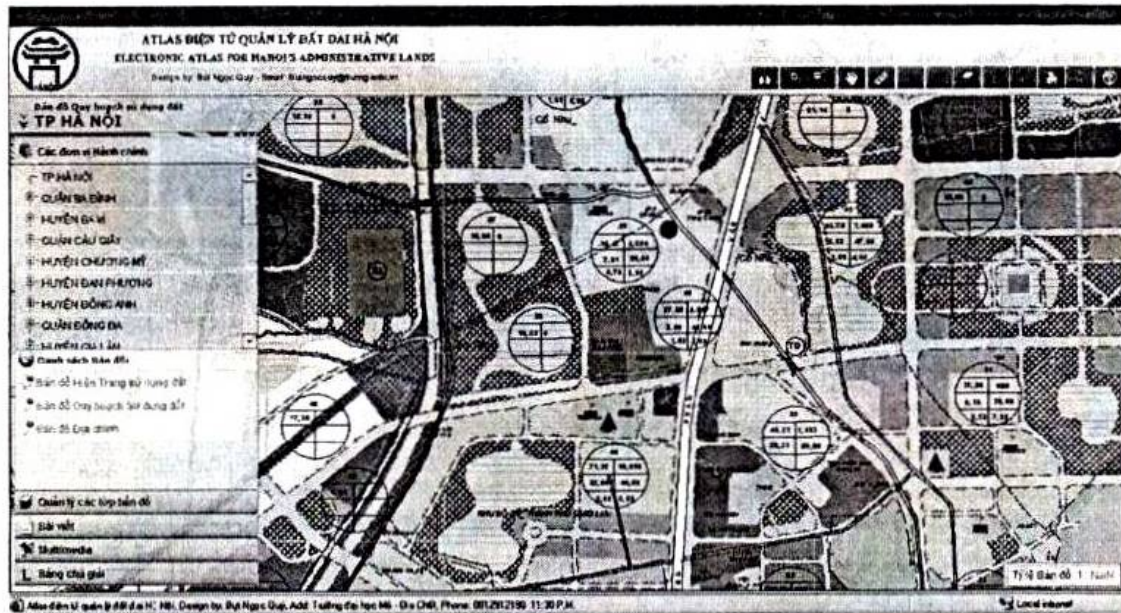


Fig. 5. Content of Map Interface.

2.5.4. The functions of Atlas

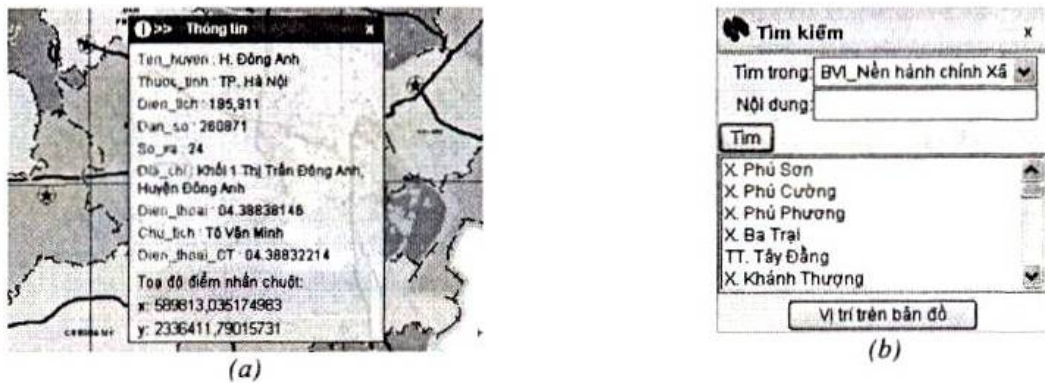


Fig. 6. Displaying object information (a); Information searching function in map (b).

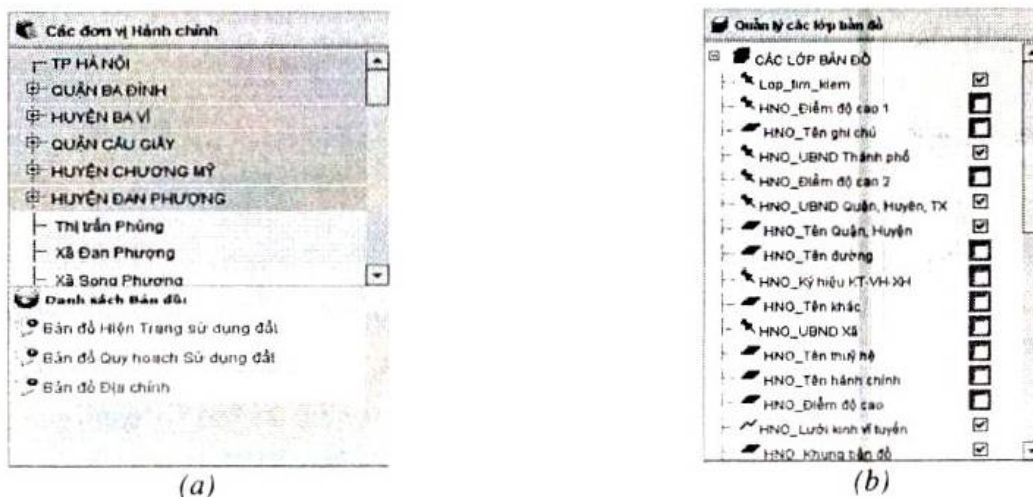


Fig. 7. Administrative unit list and List of maps (a) and Layer control (b).

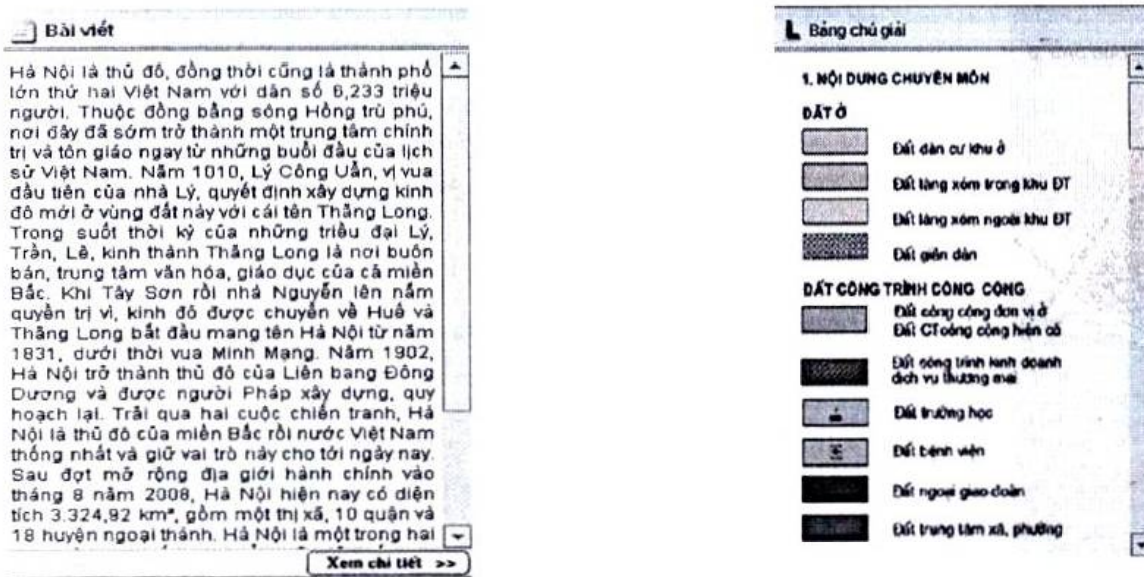


Fig. 8. Text window and legend window.

## 2.6. Package

This product has been tested and verified on PC and can fully satisfy the requirements and goals set out by project. The product is transferred to packaging stage; the data used in packaging include all map data, multimedia data and map display programs built earlier. The Electronic Atlas can be installed with a setup.exe file; user can install, setup the configurations and use directly the product on the computer PC, LAN, WAN, ...

## 3. Conclusions

After different experiments, Hanoi Electronic Atlas for land management can run smoothly and stably on different Windows platforms such as Windows XP, Windows NT and can upload on-line through communication networks.

Its structure and content meet most requirements of the traditional Atlas and have more advantages. It can provide functions to query and to display attribute information; display the map in multi scales and multi layers. The tool set is designed with various tasks to

help the user manipulate the map and find information easily.

Basically, we have developed an electronic Atlas system that meets the demand of society. With this Atlas, Hanoi people now can easily get information on land use and land planning.

Atlas needs to be built to follow the Open GIS standards so that the task to upgrade and update information of the map will be more convenient.

## Acknowledgements

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