

# **Ứng dụng WebGIS trong quản lý thông tin giá đất trên địa bàn thành phố Tuy Hòa, tỉnh Phú Yên**

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## **TÓM TẮT**

Hiện nay, việc ứng dụng GIS (Geographic Information System) trong quản lý giá đất hiện nay còn ít được quan tâm; việc xác định giá đất Nhà nước chủ yếu dựa vào bảng giá đất hàng năm do Ủy ban nhân dân cấp tỉnh ban hành, dẫn đến việc truy vấn thông tin giá đất rất khó khăn cho người quản lý và người dân. Do đó, việc ứng dụng GIS và nền tảng internet trực tuyến để người dân có thể dễ dàng tiếp cận được thông tin về giá đất và giúp cho nhà quản lý tìm kiếm thông tin giá đất nhanh chóng, đây là một việc cần thiết và thực tiễn trong công tác quản lý Nhà nước về đất đai trong thời điểm hiện nay. Trong nghiên cứu này, đã ứng dụng GIS xây dựng cơ sở dữ liệu giá đất cho thành phố Tuy Hòa, tỉnh Phú Yên dựa vào nền bản đồ địa chính theo hệ số giá đất do tỉnh Phú Yên ban hành theo vị trí tuyến đường, sau đó nghiên cứu thực hiện xây dựng website tích hợp cơ sở dữ liệu giá đất lên nền tảng trực tuyến. Kết quả nghiên cứu đã xây dựng được trang WebGIS quản lý thông tin giá đất trên địa bàn thành phố Tuy Hòa, tỉnh Phú Yên với các dữ liệu không gian và thuộc tính, chương trình này giúp cho người quản lý và người sử dụng có thể tìm kiếm trực tuyến thông tin giá đất chính xác tới từng vị trí thửa đất và tạo điều kiện thuận lợi cho công tác quản lý dữ liệu giá đất.

**Từ khóa:** Giá đất, GIS, Tuy Hòa, WebGIS.

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# Application of WebGIS for management of land price information in Tuy Hoa City, Phu Yen Province

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## ABSTRACT

Nowadays, the application of GIS (Geographic Information System) in land price management does not draw much attention. The determination of the current State land price is based on the annual land price list issued by the Provincial People's Committee, leading to the fact that the query of land price information is very difficult for everyone, especially the managers. Therefore, the application of GIS and an online internet platform that people can easily access the information on land prices, and help the managers find the information about land prices quickly is a necessary and practical issue in the state management of land. In this study, GIS was applied to build a land price database for Tuy Hoa City, Phu Yen Province, based on the cadastral map following the land price. It was coefficient issued by Phu Yen Province according to the route location. Then we researched and built a website to integrate the land price database on the online platform. The research results have built a WebGIS program to manage land price information in Tuy Hoa City, Phu Yen Province with the spatial data and attributes. This program helps the managers and users search online for accurate land price information to each land plot location and facilitate the management of land price data conveniently.

**Keywords:** *Land price, GIS, Tuy Hoa, WebGIS.*

## 1. INTRODUCTION

In-State management, the application of GIS technology to build a land price database will be an effective tool to support the management of land prices according to each land plot, location of the land plot, and street name. It is the basis to serve the specific land valuation in a favorable way. At the same time, it makes the addition and adjustment of the land price list and the construction of the annual land price adjustment more convenient and consistent with reality.<sup>1,2</sup> The spatial information management system and land price attributes integrated into the database help to look up land price information more

conveniently, especially information about land prices such as surface location, area and street name. In addition, GIS technology also helps managers easily update annual land price data for each route if there is an annual land price adjustment easily and conveniently.<sup>3</sup>

Research and application of GIS technology in the state management of land and other fields have been carried out in Vietnam recently. The subjects have exploited the features and utilities of software tools for database management, meeting the needs for information technology development in the new era. Especially, research projects on the application of new technologies

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in land price management are interesting and have been deployed in a number of provinces in the country such as Dong Nai, Thua Thien Hue, Quang Binh, etc.

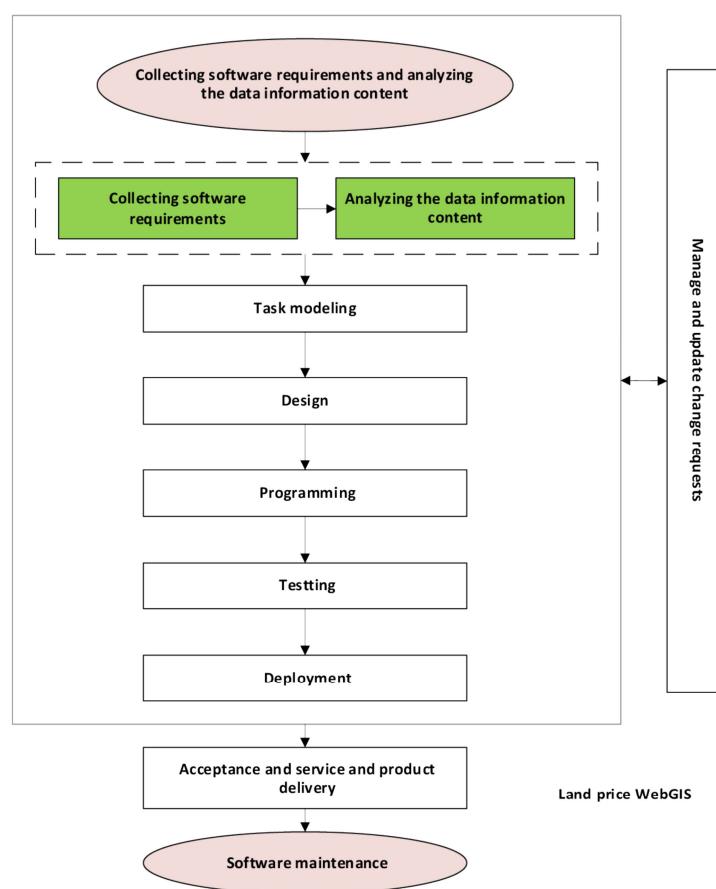
Phu Yen is a coastal province in the South-Central Coast of Vietnam with a natural area of 5,045 km<sup>2</sup> and a coastline of 189 km. These days, Phu Yen province is promoting and attracting investment in Tuy Hoa city in order to build Tuy Hoa city into a modern and dynamic urban area, and land price is one of the key factors. The first thing that investors pay attention to is to choose an investment location. Therefore, the construction of a land price map will help investors be more proactive in collecting information on land prices and choosing a suitable location, thus facilitating investment attraction.<sup>4</sup>

For the above reasons, it is necessary to apply WebGIS to management of land price information in Tuy Hoa city, Phu Yen province. It will solve many economic problems, apply practical applications in local land price management, help land price management in Tuy Hoa city become more effective, and meet the requirements in the current financial management of land.

## 2. RESEARCH PROCEDURES AND METHODS

### 2.1. Research process

The development of WebGIS website is based on the provisions of Circular No. 26/2014/TT-BTNMT dated May 28, 2014 of the Ministry of Natural Resources and Environment.<sup>2</sup>



**Figure 1.** Overview of the process of building a WebGIS website for land prices.

## 2.2. Research methods

To accomplish the above content, the study used the following methods:

+ Methods of data collection and field investigation: Collecting data, including geographic background data, cadastral maps, current land use maps, satellite image data and land price data survey market from the study area.

+ Methods of synthesizing, analyzing and editing data: Data are collected directly in the field and collected through secondary information channels in departments, in-depth research groups, data related to land price list in Tuy Hoa city, natural and socio-economic conditions. From the analysis and processing, the collected data is the input data for the construction of WebGIS. The most important and most accurate document is the cadastral map and land price data according to different types of land prices along with routes and each parcel of land.<sup>5</sup>

+ Methods of applying GIS technology: The method presented research results and research contents on graphic space with a unified mathematical basis and standard spatial and attribute databases.

This is an important method in building land price maps. Research and use ArcGIS technology to build a GIS database of residential land prices to create a map of residential land prices in Tuy Hoa city, Phu Yen province includes the following contents:

+ Organizing a GIS database on residential land prices and using algorithms to analyze, synthesize and process data.

+ Setting up traffic system data, residential area according to the traffic system.

+ Setting detailed residential land prices according to the State land price bracket according to the main street route and the location of alleys in the study area.

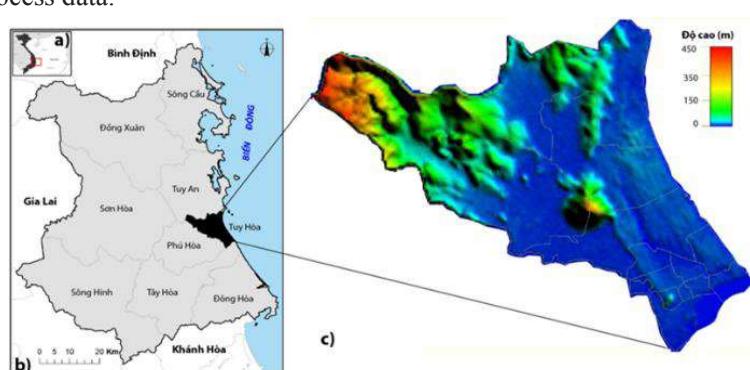
+ Building a map of land prices in Tuy Hoa city, Phu Yen province.

+ Method of application of WebGIS technology: It allows the design of the WebGIS structure diagram, design of WebGIS user interface, test operation of WebGIS system: installation on the server (Server) and test operation with the source name address is installed on the server, the website accesses the land price system: <http://giadattuyhoa.com/>. At the same time, it allows users to view information, and management agencies can log in to the database management system and view land price information for each land parcel, update the map data system and other information. information on regulations on land prices.

## 3. RESEARCH RESULTS AND DISCUSSION

### 3.1. Introduction of the study area

Tuy Hoa city is the economic and cultural center of Phu Yen province, with a natural area of about 107.3 km<sup>2</sup>, a population of over 202 thousand people (by 2020) with 16 administrative units (including 12 wards and 4 communes). Tuy Hoa city is located adjacent to Phu Hoa district, Tuy An district, Dong Hoa district, Son Hoa district and to the East by the East Sea.



**Figure 2.** Map of study area Tuy Hoa city, Phu Yen province.

Tuy Hoa city has a fairly flat topography with little division. The city has a humid tropical monsoon climate typical of the South-Central region. However, because it is located close to the sea, the climate is quite moderate. The east of the city borders the sea with a coastline of more than 30 km extending from Xuan Hai Bay to Vung Ro. The coast has many beautiful landscapes and beaches alternating both coastal and inland, such as Tuy Hoa beach, Nhan tower, Chop Chai Mountain and nearby scenic spots such as Long Thuy beach, Ganh Da Dia, O Loan lagoon, Doi Thom tourist area, etc. These are very convenient for tourism development and aquaculture. Tuy Hoa is also the crossroads and convergence of many important traffic routes, such as National Highway 1A, Highway 25 to Gia Lai, Highway 29 to Dak Lak, North-South railway, Tuy Hoa airport, Vung Ro seaport, etc.

In short, the advantages of natural, socio-economic conditions and infrastructure have created favorable conditions for the city to develop in a variety of fields, especially the marine economy. This is an outstanding strength for the city to become a major administrative and economic center not only of Phu Yen province but also of the region and a place of East - West and North - South economic exchanges of the whole country.

### **3.2. Building a database of land prices in Tuy Hoa city, Phu Yen province**

#### *3.2.1. Spatial data construction*

In order to build a database of land prices for each location of the land plot, the study proceeds to build spatial information layers such as Land plot and traffic objects along routes, which are divided into main roads associated with the names of roads and alleys according to levels affecting land prices. The process of building a database in accordance with the provisions of Circular 02/2012/TT-BTNMT dated March 19, 2012, of the Minister of Natural Resources and Environment on basic geographic information

standards; Circular 17/2010/BTNMT dated October 4, 2010, providing technical regulations on cadastral data standards; Official Dispatch 1159/TCQLDD-CDKTK dated September 21, 2011, providing guidance on building cadastral database.<sup>1,6</sup>

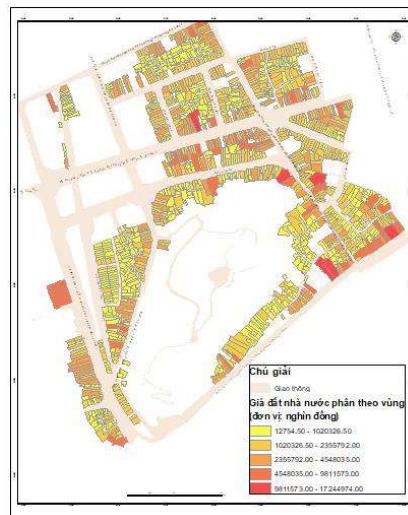
The spatial land price database is built on the VN-2000 coordinate system, spatially normalized data for each parcel of land along with traffic data for the streets. Then, the topology to correct spatial errors and build spatial linkages for land parcels is standardized, meeting the requirements of current database standards.

#### *3.2.2. Building a database of land price attributes*

In this study, we used land price table data issued by the People's Committee of Phu Yen province and applied for 5 years for the period 2020 - 2024, which was collected from the Department of Natural Resources and Environment of Phu Yen province. The information in the form of tabular attributes is filtered through the land price information according to the location of the routes and arranged to link with spatial data through the attribute fields by route, in which the data Traffic has been normalized from the cadastral map.<sup>5,6</sup>

After obtaining land price information according to the research routes, we have built land prices for each location of the land plot based on the location of the route and the width of the alley. To do this, we used tools to query land plot information by the main route to assign land prices to roads. Then, the land plots in the alley are queried in turn according to the width of the alley which is specified in the issued land price list.

After obtaining land prices for the roads and alleys, we performed the location of the frontage to calculate the land value for these locations increasing by 10%. After that, we used GIS tools to build a land price map for Tuy Hoa city in the period of 2020 - 2024.



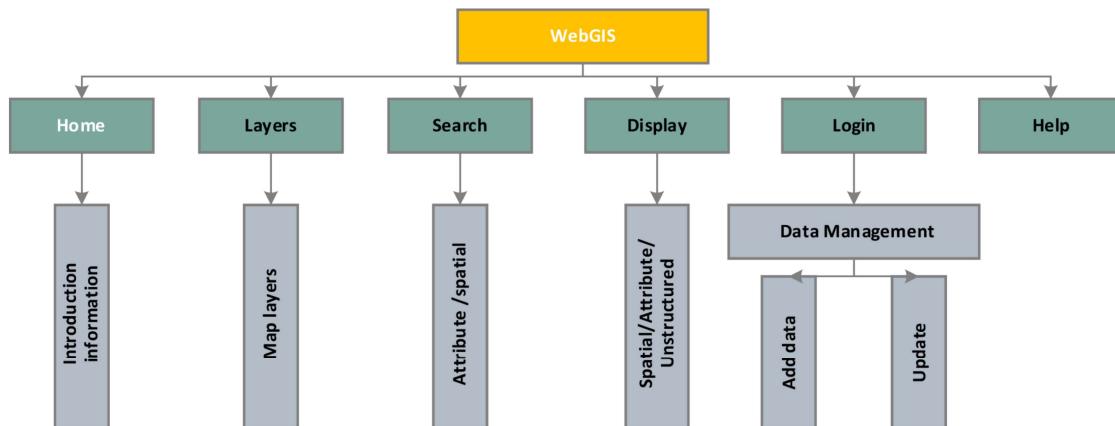
**Figure 3.** State land price database by streets in Tuy Hoa city.

### 3.3. Designing the interface of the WebGIS to manage land prices in Tuy Hoa city

#### 3.3.1. Setting up the graphical interface

The graphical interface is designed based on the WebGIS platform, consisting of two contents.

The first is the data content interface, specifically spatial data (map). The second is the graphical interface of the WebGIS, which is designed for users to control directly on devices connected to the Internet.



**Figure 4.** WebGIS organization chart Tuy Hoa city land price.

WebGIS includes homepage, layers, search, display, login and assistance:

- + Home page (Menu): Showing general information.
- + Layers: Representing spatial data layers related to geographic background data and land prices.
- + Search: Helping users search for information on the map by keywords, searching

for information related to land prices by location of routes and each parcel of land.

+ Display function: The area has the function of displaying spatial information and data. This is a very important content that represents most of the information of a WebGIS site.

+ Login: The searcher logs in to his/her personal account (username, password). This content is for site administrators.... After

logging in, and going to the management pages, the manager can add new information about land prices and update, including the features of adding, deleting, and editing information of geographic background data and land prices...

+ Assistance: WebGIS manual page, contacting information.

### 3.3.2. Guidelines for general and detailed interface design WebGIS

- The general interface of the user page includes the homepage, search, and introduction pages (see information designed as shown in Figure 5).

- System login page interface: It helps managers to log in to the WebGIS system to serve more users, change login information, etc.

HEADER	
MENU	
Tool and search	Layer
Map	
Display information	
FOOTER	

**Figure 5.** WebGIS general design interface for land price management.

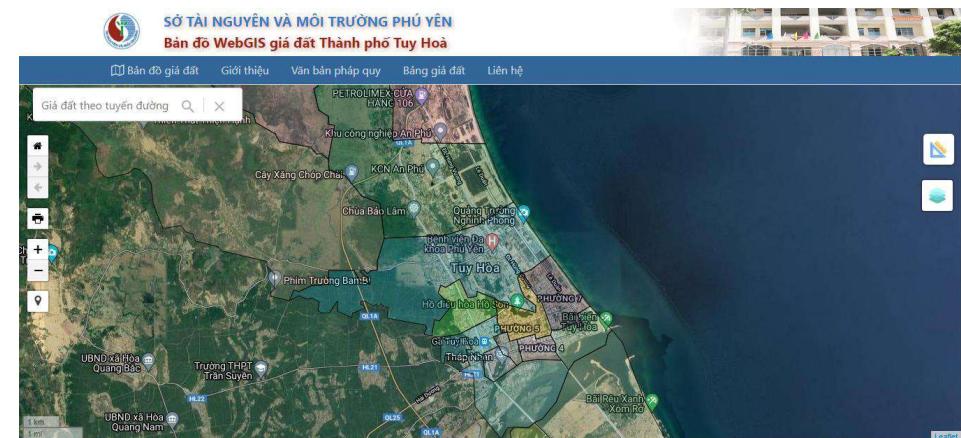
- Map management interface: Users can add information to the geographic base database and land prices to periodically update the data for WebGIS.

HEADER	
MENU	
Geodata background group	Add data
	Save
Land price data group	Add data
	Save
FOOTER	

**Figure 6.** Map management design interface.

### 3.3.3. Programming WebGIS webpage components

The Web uses Leaflet's method of connecting libraries to display information, mainly by JavaScript. The interconnected JavaScripts connect the GeoJSON data and display them on the map, including the map background data and the attribute data. The detailed code is to develop the function of displaying the map, searching for information, moving the map, zooming in, out, etc. WebGIS are programmed, developed and shared on the homepage [giadattuyhoa.com](http://giadattuyhoa.com) help people view GIS-based land price information online.



**Figure 7.** WebGIS interface to manage land prices in Tuy Hoa city.

- The main tools of WebGIS, which are frequently used to meet the main functions of WebGIS, are displayed by default in the vertical toolbars on the right: For example, tools to zoom in and out, move the map, search for land price

information according to the location of the routes, printing, etc.

- Data layer management framework is a list of online map data layers that can be added to help identify and display available landmarks

on Google map, OpenStreet Map and distance measurement functions directly on the WebGIS platform.

- The area of legal documents and land price list is placed on the above horizontal bar so that users can view legal documents and contact the land price data management agency in Tuy Hoa city.<sup>9,10</sup>

- The status bar shows the scale of the map.
- The main area of Web-based GIS data.

**Table 1.** Tool group on the left side of WebGIS interface.

Image	Tool name	Main function
	Zoom in	Zoom in on the map display area in the selected area by dragging the mouse.
	Zoom out	Minimize the visible area on the main canvas by dragging the mouse.
	Positioning	Finding your current location - GPS.
	Full screen	Displaying all information layers and data processing frame.
	Moving	Moving the map information layers that have been opened in the Main Data Processing and Display Frame.
	Printing	Printing map, printing according to the selected area, printing the whole map area, printing vertically, printing horizontally on the screen, etc.
	Searching for land sales	Searching for land price information by the route.

*3.4.2. Framework to manage data layers, search, measure, information menu*

**3.4. Building tools, utilities and manipulating functions on the WebGIS program to manage land prices in Tuy Hoa city**

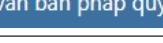
These tools help users customize the display of information layers used on the display and data processing frames.

*3.4.1. The tool group is displayed on the left in the WebGIS interface*

The main tools shown above are detailed in the following table:

In the upper frame of the WebGIS interface, there are the following main items:

**Table 2.** Main functions on the right of WebGIS.

Illustration	Tool name	Main function
	Land price map	Display of the entire land price map of the whole city, helping users locate the wards
	Introduction	A brief introduction to the online land price map
	Legal documents	Legal documents related to the current land price bracket
	Land price list	Land price list for the city in text form

On the right of the WebGIS interface, there are functional toolbars that measure the

distance between points on the map, switch on map data layers, specifically as follows:

**Table 3.** Tool group on the right of the WebGIS interface.

Illustration	Tool name	Main function
	Measurements	Measure and calculate distance, area in square meters and hectares.
	Data layers	Manage the switch data layers on WebGIS.

### 3.4.3. Working with main features on WebGIS

Users can exploit the main features on WebGIS to manage land price databases such as View land price maps online; Displaying attribute

information; Looking for information; Print maps online; Positioning; logging in and updating data (for managers). Viewing the land price map is done through the function of zooming in and out of the map, displaying data layers.



**Figure 8.** Area for managing data layers.

### Displaying road property information

The purpose is to display detailed information on the selected data background to help show data more intuitively. In the WebGIS interface, the function of displaying street names by streets has been implemented, helping people to easily search for the location of the land plot and land price quickly and conveniently,

by zooming in to the search area, the road information will be displayed visually.

### Finding information on the map

Purpose: Helping users easily find information about land prices quickly and intuitively; electing the icon  then typing the street name and clicking the search button .

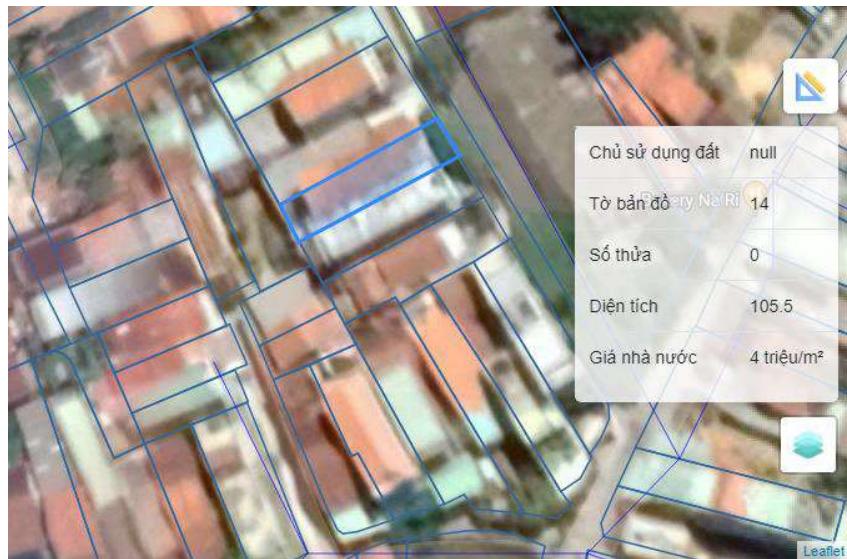


Figure 9. Illustrated image of searching for information by a parcel of land.

Bảng giá đất						
		Năm:	2020-2024			
Phường/xã		Phường 8				
Xem bảng giá đất						
STT	Tên đường				DVT: 1.000 đồng/m <sup>2</sup>	
1	Lê Thành Phương - Đoạn từ đường Trần Phú đến đại lộ Nguyễn Tất Thành		VT1	VT2	VT3	VT4
2	Nguyễn Trung Trực - Đoạn từ đường Trần Phú đến Nguyễn Bình Khiêm		8.000	5.500	4.000	2.500
3	Nguyễn Tất Thành - Đoạn từ đường Trần Hưng Đạo đến ranh giới phường 8 và phường 9		16.000	11.000	8.000	5.000
4	Nguyễn Tất Thành - Đoạn từ ranh giới phường 8 và phường 9 đến ranh giới phường 9 và xã Bình Kiến		13.000	10.000	7.000	5.000

Figure 10. Illustrative image of looking up land price information attributes by administrative unit.

#### Attribute information search

Not only does design information search according to spatial data, but the program also designs a window to search for land price information by year and by administrative units, thereby helping users to easily access information about desired land prices and can know land prices according to locations on a route.

#### Printing map online

It is an operation to extract information in an image format for printing. This function is intended to help users print data online. To print the map, we select the icon and print.



Figure 11. Illustration for online map printing.

#### Reallocation locator - GPS

Purpose: Helping the user determine the current location, this function helps the user in finding the route conveniently. We select the positioning function to determine the actual location. If we use a smartphone, we must turn on the location function to use it.

#### 3.4.4. Program management and security

The program manager's job is only granted to the top manager, and this person has the right to create accounts for other managers. The authorization on WebGIS is divided into 2 levels as follows:

Admin (supreme administrator) of WebGIS site: admin has all rights such as login account, adding, editing account, adding a user account, changing website blog appearance, changing status menu, website banner, etc. Admin is a technical officer involved in the management of land price information of agencies Department of Natural Resources and Environment of Phu Yen province, Department of Natural Resources and Environment of Tuy Hoa city.

The administrator is the person who manages the land price data catalog. He can exploit the information and has the right to use other functions of the system provided by the

administrator. Administrators can select “Login” on the WebGIS Menu to log in to the system. After entering the username and password, log in for the following results: In the System section, the administrator can change the login information or add a username. Users who access the system's portal have the right to look up, share and exploit land price information of Tuy Hoa city. However, people who are not administrators are not provided with the system login name and password.

#### 4. CONCLUSION

The article has built a WebGIS website which supports the management of land prices in Tuy Hoa city, Phu Yen province. The results of the article on building a WebGIS program for integrating land prices on an online platform will help people and land managers to quickly search for land price information at land plot locations within a specific area and to each parcel of land. The WebGIS program on land prices in Tuy Hoa city is built according to the land price list prescribed by the State. Therefore, it helps to provide transparent information to the people, so that people can know information about the land area and land price according to regulations easily. On the other hand, the system supports searching for land price information by routes through the web environment and

online base map, which is convenient for people and managers in using and querying. Research results are an important tool in land management and use, creating favorable conditions for people and managers in querying information about land prices and the location of land plots in Tuy Hoa as well as throughout the province in the years to come.

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