A New Approach for Computing Housing Tax Rates

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***Abstract*—**In this paper a new service for E-Government is presented. A new technique for computing housing tax rates is introduced as an essential part in the framework of e-government. The proposed approach relies on integrating geographic information system (GIS) and global positioning system (GPS) to achieve efficient decision support system (DSS) for perfect calculation of housing tax rates. Furthermore, the design of DSS framework for E-government is described. Such approach is applied for the Egyptian ministry of finance in the form of e-service. The aim is to construct a complete e-government system that facilitates e-services for its partnerships such as citizens, businesses, employees as well as the government itself. Our proposed e-service clarifies the importance of the geographical criterions that affect the values of housing tax rates. By using this new e-service, the mission of the housing tax rates committee becomes easier as the calculation of housing tax rates is done automatically. As a result, the time required to manually check and investigate all buildings and housing units in the country is reduced. The presented approach can be applied for computing any other types of taxes that depend on the geographical position.

***Keywords*—** E-government, E-services, GIS, GPS, DSS and Housing tax rates.

I. Introduction

E-government involves using information technology, and especially the Internet, to improve the delivery of government services to citizens, businesses, and other government agencies to interact and receive services from the federal, state or local governments twenty four hours a day, seven days a week. It transforms the public service into electronic service via information and communication technologies (ICT). Nowadays, the rapid development of computer technology as Internet facilitates easy access to data, information, and knowledge sources which are available online. The Egyptian government gives impetus to the development of ICT in Egypt. It concentrates on linking them to the economic and social development of the Egyptian country [1]. This is to move from manual information system to computer based one. The information society should be able to deliver high quality government services to the public where they are and in the format that is suitable for them. Egyptian e-government was created since 2001 for many reasons. First, in order to reach a new level of convenience in government services. Second, to offer citizens the opportunity to share in the decision making process. Third, to greatly improve efficiency and quality of services. Fourth, to enhance the Egyptian economy and help in increasing production In the last year, the ministry of finance applied a new rules for computing the housing tax rates to increase its ability for payment and to support the other needs [1-2]. The question here is how to determine the tax rates?, How to get it quickly?, and finally how to scan all units in short time?. Here, GIS is used to easy access the all units at the same time and get all the required information about the owners [8-10].

This paper is organized as follows. Section 2 explains the technology of e-service and reason for using this e-government. The proposed environment for DSS in E-government is presented in section 3. The combination of GIS with GPS to provide an efficient DSS for determination of housing tax rates is discussed in section 4. Finally, conclusions are given in section 5.

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II. E-service Technology

E-government is now a central theme in information society at all levels: local, national, regional and even global. It can be defined as a transformation of public-sector internal and external relationships through use of ICT to promote greater accountability of the Government, increase efficiency and cost-effectiveness and create a greater constituency participation. Countries of the Asian and Pacific region engage in e-government, as they provide cost-effective government-related information via Web sites and most have already developed a national e-government strategy (often as part of an ICT strategy plan). The emerging economies in the region have already gone one step further in introducing internal information management at various levels of sophistication. However, only a few Governments in the region have successfully implemented a comprehensive set of online public services, and even fewer have backed these operations up with comprehensive knowledge management in ministries and

Manuscript received October 19, 2010: Revised version received June 4, 2011.

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between the various government agencies. Even though, most Governments in the region are eager to further benefit from e-government, by improving efficiency and transparency of the public sector, and providing inclusive public services, they may feel that e-government is a concept far removed from their current realities. ICT applications in the public sector can be used as a strategic tool for development and also a response to the current challenges of globalization. For all Governments, e-government was a fundamental complement to the successful implementation of a range of other government policy targets. E-government was clearly linked to the international competitiveness of an economy and was a fundamental driver of economic growth along with monetary, fiscal, labour and trade policies. E-government pushed the limits of traditional government, changing the way in which government functioned and fostering a culture that made the customer and citizen central to everything it did. It involved building an integrated, enabling infrastructure that could meet the requirements of today's environment, while being readily adaptable to new and innovative developments [11].

While the benefits of e-government were growing, there remained a need for a better understanding of the impact and role of e-government. Owing to the tremendous resources required in implementing e-government, the sharing of knowledge and experience could help developing countries in the region to reduce costs and limit unnecessary mistakes. However, there was a need to define an e-government agenda, and give priorities and specific recommendations on how best to move e-government forward. E-government had impacted on all levels of government. Successful economies were those where a central coordinating agency had been formed to oversee the shift to e-government. If there was not a uniform approach, e-government was destined to failure. E-government could have effects on policy and programs objectives through:

• Improved services, e.g. customer satisfaction, burden reduction and savings
• Enhanced economic development
• Improved policy formulation
• Redefined communities
• Increased operational efficiency
• Enhanced citizen participation

Furthermore, e-government could be used as an anchor to drive transformation across the public and private sector and as a tool to drive foreign investment and economic development. It was important not to over emphasize the role of technology – technology was often a large part of cost, and only a small part of success. To ensure success, the following items are needed to be done:

• Become customer-centric
• Learn how to cope with change
• Develop technical infrastructure
• Collaborate for success
• Work across silos, break down traditional, hierarchical structures
• Develop performance measures

All of those elements were necessary for transforming the government. The technological infrastructure was the base upon which other changes could be made. For overall transformation in the government those issues are needed to be examined in the context of one another [11].

The Egyptian ministry of finance introduced new rules for computing the housing tax since 2009. Housing tax rate is determined by some of important criterions. Such criterions are:

1. The total numbers of floors.
2. The area of the house.
3. The space around the house.
4. The location of the house.
5. The strategic position which means whether the house is nearing from a global location such as river, garden or public streets/places.

The ministry of finance assigned this complex task to the committee of evaluation and control. Such committee is responsible for calculating the housing tax rates. The duties of this committee are:

1. Collecting data entered by owners
2. Reviewing such data.
3. Checking the correctness of this data.
4. Scanning all buildings, streets and every other location.
5. Investigate the total income for each owner.
6. Computing the ratio between the total income for the owner and the number of members in his family.
7. Deciding about the way of payment along the year.

It is obvious that it will be very difficult to calculate the tax rates. Moreover, it is expected that those procedures will consume long time. The process of calculating the tax is sharable with the help of the owners of units. The owners introduce a real estate tax declaration either electronically on line or by handling it in the offices of Egyptian ministry of finance. The committee can ensure the correctness of the entered data by owner via our novel e-service. The evaluation of any e-service is customer based. Therefore, the determination of the quality of e-services should be performed. This can be done by the customers themselves.

III. DSS FOR E-GOVERNMENT

Fig. 1 presents a designed DSS framework that intended for e-government planners and its top managers, scientific researchers, ministers, e-government partnerships and decision-makers. The input of DSS would include stakeholder concerns, parameters/variables, required characteristics, tasks or problems, system strategies, priority, and asking specific alternatives. Desired DSS output include graphic and numeric results relating to economic analysis, evidence of performance; cost savings, time, and quality moreover efficiency and effectiveness. The database management module contains the National database, the financial data, statistical data, department's portals, accessing catalogue resources and Shared Information. The model management module provides

the environment for storing, retrieving, and manipulating models. It links the user to the appropriate mathematical models, optimization methods, analytical tools, and procedures to perform various types of analyses [98].

The knowledge base module contains problem-specific rules and facts relating to e-government operations, its e-services, as well as the ability to use soft computing techniques. This module makes available expert knowledge to substitute human expertise for missing algorithms. The incorporation of intelligent DSS functionalities in the form of soft computing adds the ability to process both quantitative and qualitative data at varying levels of precision.

The user interface module provides the means for the user to interface with the DSS and to (1) Access the database, model base, and expert knowledge base; (2) Input information such e-government website and its e-services;(3) Display and analyze data and formulate and evaluate alternative decisions; and (4) View output displays.

IV. Integrating GIS, GPS, and DSS to Provide Efficient E-Service

While much of e-government relied on telecommunication innovations such as bandwidth and speed, there was also a need to focus on how to distribute e-government applications to potential users. E-government access was about providing services to citizens and business in ways that they chose to apply to them, at a time appropriate to them. Further, universal access was essential. Therefore, providers must choose the most appropriate delivery channels.

DSS are mechanisms that can be used to provide managers with information needed to make managerial decisions [12-73]. Decision support systems are gaining recognition in the public sector, which seeks solutions to various problems in a number of diverse areas. Many solutions are closely tied to individual fields, such as medicine [74], ecology [75] and spatial planning [76]. Others, in a more general way, are directed towards support in strategic planning and solving problems in management [77-78]. Lately, due to the redirection of politics away from ascertaining public opinion about the functioning of the public sector towards public engagement and cooperation in decision making processes, the number of solutions in the area of e-democracy is increasing [79-82]. Support systems and cooperation in decision making are, however, still used mainly in narrow professional circles and have not found their way to political decision makers or to the public [83]. The challenge of successful implementation of a decision support system in the public sector, with engagement over the whole spectrum of decision making, is still unmet [84-95].

GIS is a specialized information system having all the basic possibilities of an information system as query, reporting as well as data storage and retrieval [76]. A data model is a representation of some real world phenomenon for which information will be stored in a database. Storing information in a database has many benefits such as allowing the user to perform complicated analytical functions and queries, handling large amounts of data, imposing certain rules on the stored data. GIS makes use of attribute data associated with geographical data (spatial data) [4]. Geographical data may be represented as points, lines or polygons. Attribute data can be handled easily using a conventional database management system (DBMS) [3-7]. GIS has the ability to query this spatial data. GIS is defined by its ability to cater for spatial queries. GIS allows you to query and find geographical features using addresses. Moreover GIS is spatial analysis tools [12-73]. GIS is used in our proposed e-service as a tool to help the committee of evaluation and control in determining the values of housing rate taxes perfectly. After many interviews with mangers in the Egyptian ministry of finance, they told us about the major important criterions to evaluate the values of tax rates. Table 1 shows the most important criterions that affect the values of tax rates and its corresponding GIS data in the representation layer.

The novel GIS e-service is used as a tool to support the committee of evaluation and control in order to reduce the time consumed to manually checking every flat in all cities. Fig. 2 describes the block diagram for the steps of our novel GIS e-service. The proposed e-service not only helps the citizen but also all the partners of the Egyptian e-government. The satellite moons will capture all towns in Egypt. Another way is to get the maps from Google Earth. The process of digitizing converts the master map into vector map by determining the important real world criterions as shown in Table 1. Examples for these criterions are gardens layers, and rivers. The owners of the housing units access the online tax declaration form and enter the data properties of their units. The committee of evaluation and control can determine the values of the housing tax rates depending on the resulted spatial data. The flow chart of the housing tax computation rates is shown in Fig. 3. Fig. 4 shows the interface of the proposed GIS e-service. The selected location in any city and its different layers are appeared. Fig. 5 clarifies the final segmentation of the real world geographical criterions that affect the values of the tax rates. Spatial query interface for supporting the committee is presented in Fig. 6. Fig.7 describes the main responsibility of the unit owners which is to enter data of their units like location, size, type (such as apartment, villa or building and so on). The committee of evaluation and control can use latitude and longitude query through our novel GIS e-service to get information about any location or unit. The GPS can be used as manual equipment in order to check the correctness of owner data that is entered into the main property form. GPS finds the actual real latitude and longitude degrees. Fig. 8 presents the results of committee's query about the latitude and longitude of random checking building.

Table 2 shows the difference between traditional manual service and our novel e-service. The traditional manual service needs more effort than our new e-service. This is because the effort to manually scanning all units is very huge. The novel GIS e-service reduces the time consumed compared with manual checking at every flat in all cities.

V. CONCLUSION

A new e-service for e-government has been presented. Such service has been introduced for computing housing tax rates. It has been shown that such technique facilitates this governmental service for citizens as well as committee of evaluation and control. The values of the tax rates have been estimated in real-time. Furthermore, all of the housing units have been scanned simultaneously. This has been achieved by applying GIS in e-government systems. In addition, it has been proven that the combination of GIS and GPS for DSS has developed the e-services in the Egyptian ministry of finance. Moreover, the tax rate of any flat has been computed accurately according to its location by using the proposed e-service. Compared to the manual computing system for housing tax rates, the required time has been reduced by using our proposed technique for any housing unit in the city. The presented approach can be applied for computing any other types of taxes that depend on the geographical location. The general framework for DSS in E-Government has been described.

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Dr. El-Bakry has United States Patent No. 20060098887, 2006. Furthermore, he is associate editor for journal of computer science and network security (IJCSNS), journal of convergence in information technology (JCIT), International Journal of Digital Content Technology and its Applications (JDCTA), and International Journal of Advancements in

Computing Technology (IJACT). Furthermore, he is a referee for IEEE Transactions on Signal Processing, Journal of Applied Soft Computing, the International Journal of Machine Graphics & Vision, Journal of Pattern Recognition, Information Fusion Journal, the International Journal of Computer Science and Network Security, and many different international conferences organized by IEEE. In addition, he has been awarded the Japanese Computer & Communication prize in April 2006. He has also been awarded the best paper prize in two international conferences and Mansoura university prize for scientific publication in 2010. Moreover, he has been selected in who is who in Asia 2007 and BIC 100 educators in Africa 2008.

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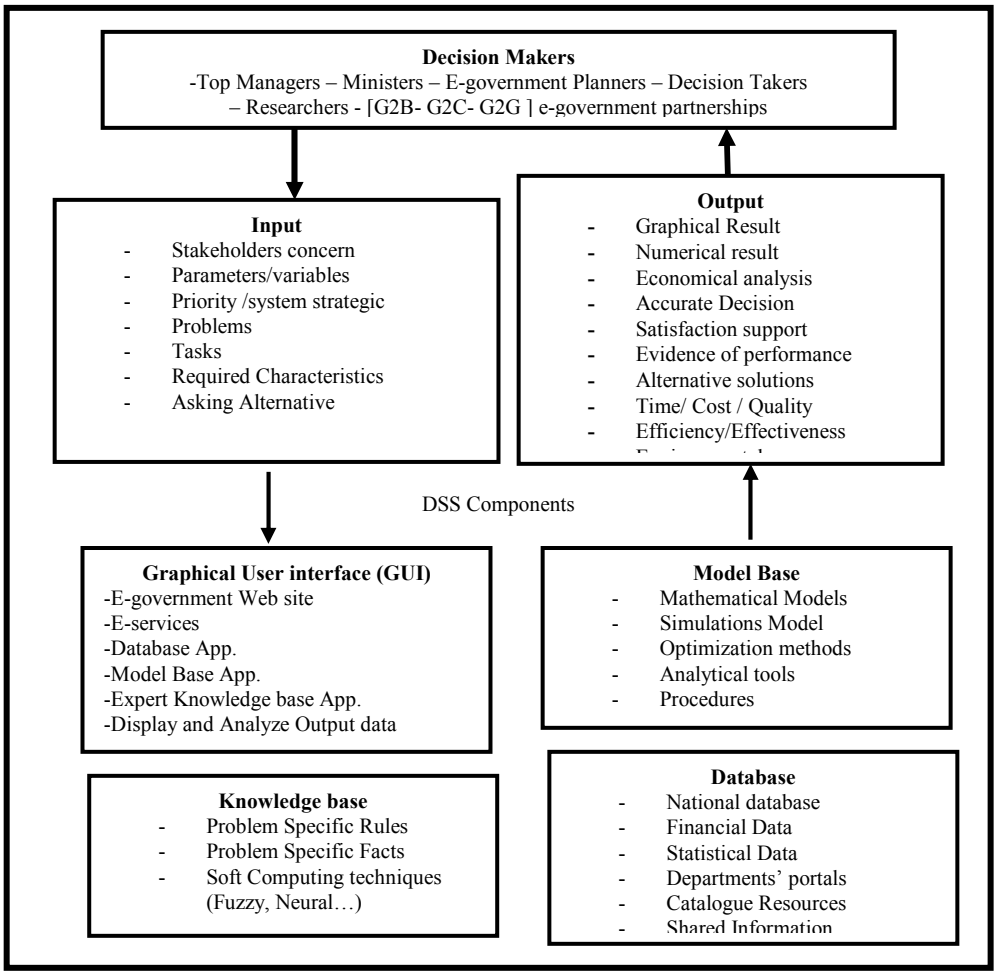

Fig. 1 DSS Framework for E-government [98].

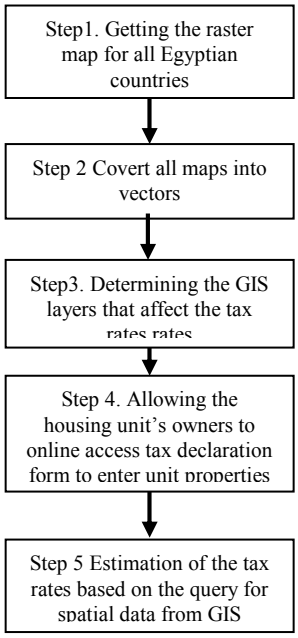

Fig. 2 Block diagram for the steps of the novel e-services

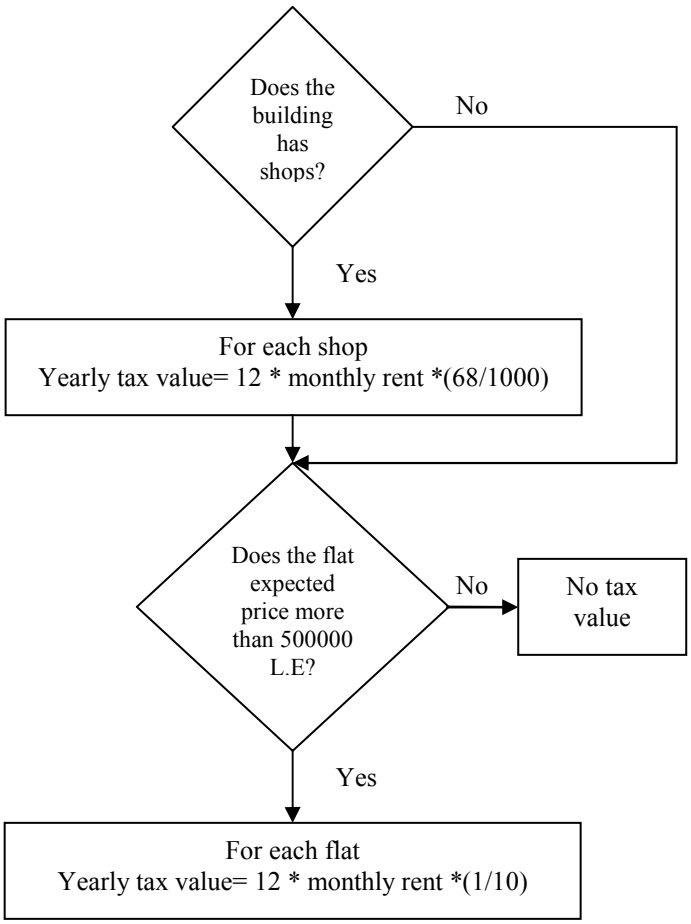

Fig. 3 Flow chart of the computational method for housing tax rates

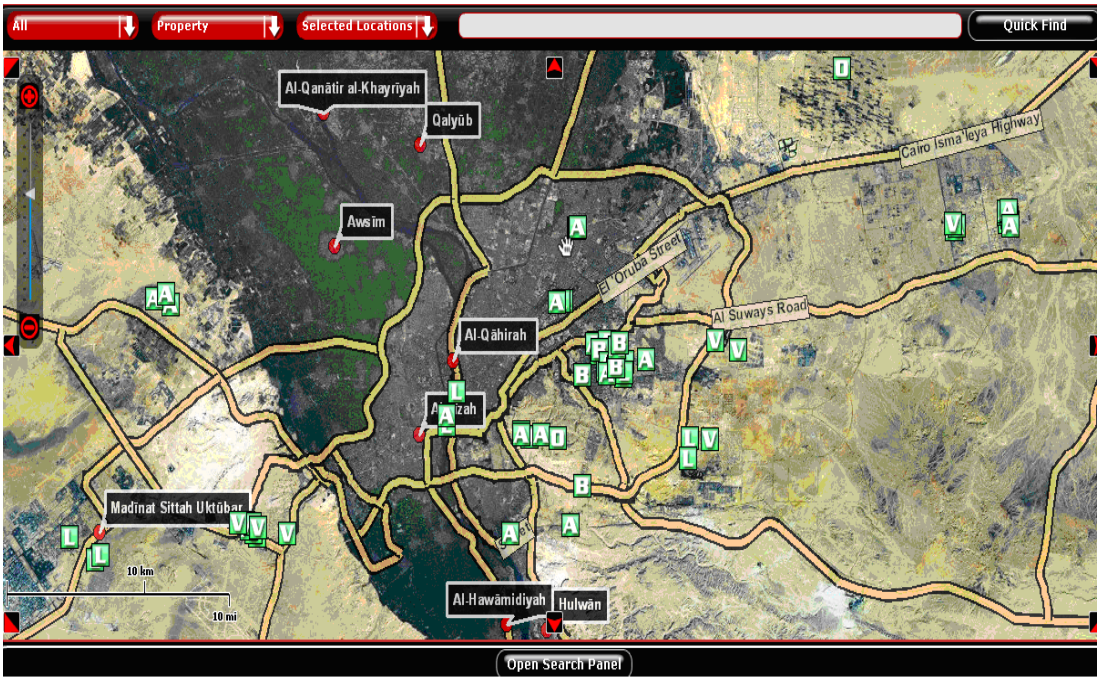

Fig. 4 Interface of the proposed GIS e-service

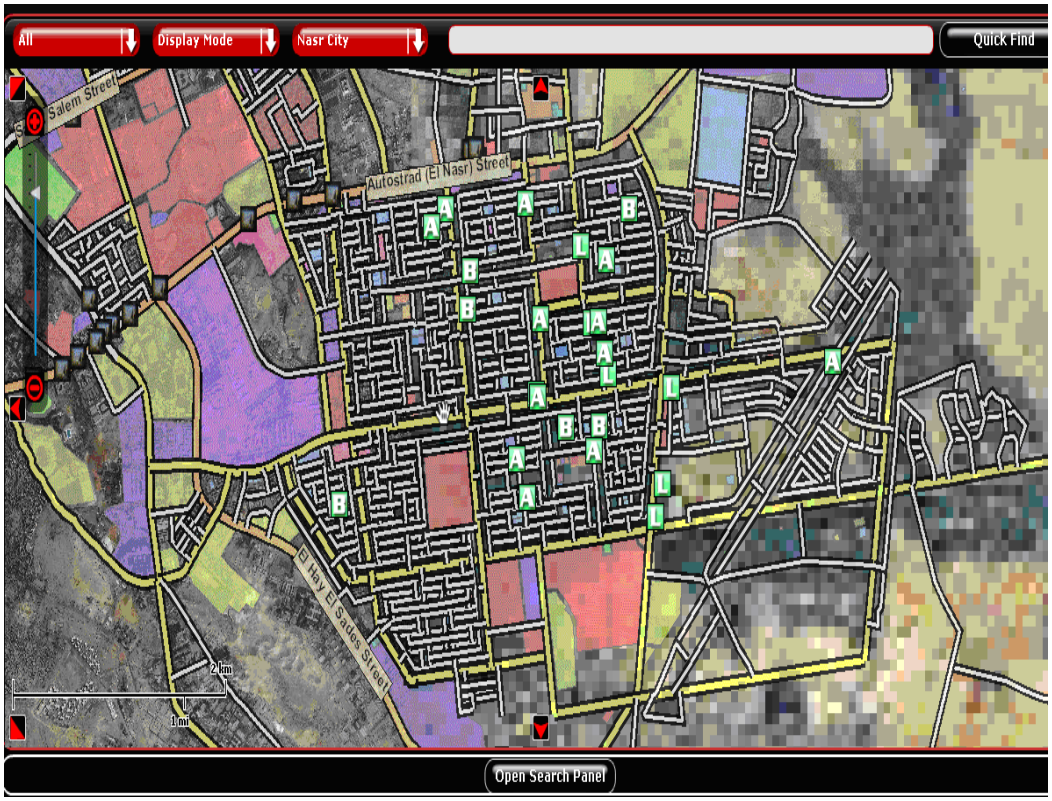

Fig. 5 Interface for final GIS layers

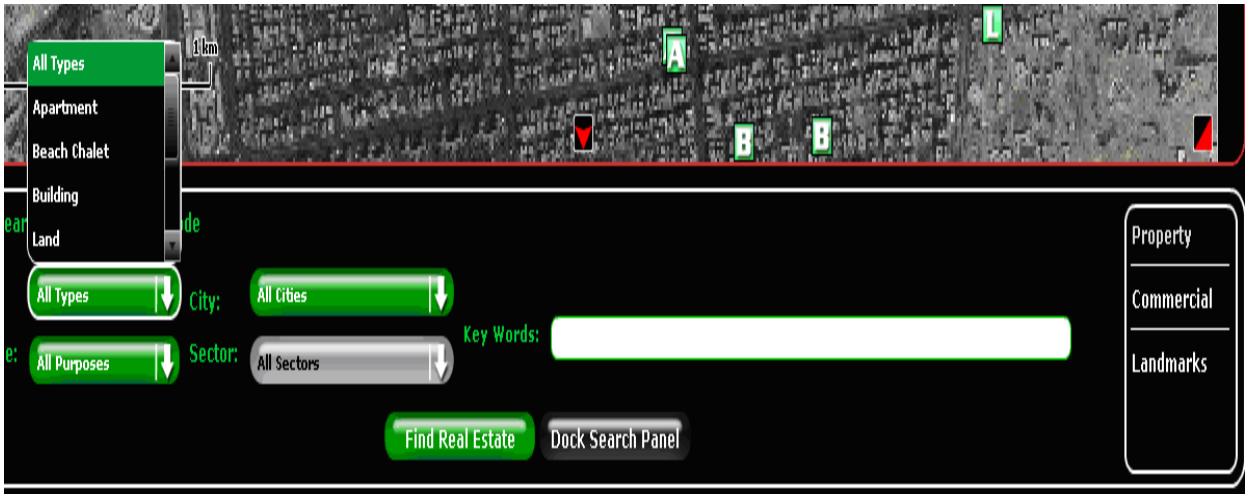

Fig. 6 Query Interface for the committee

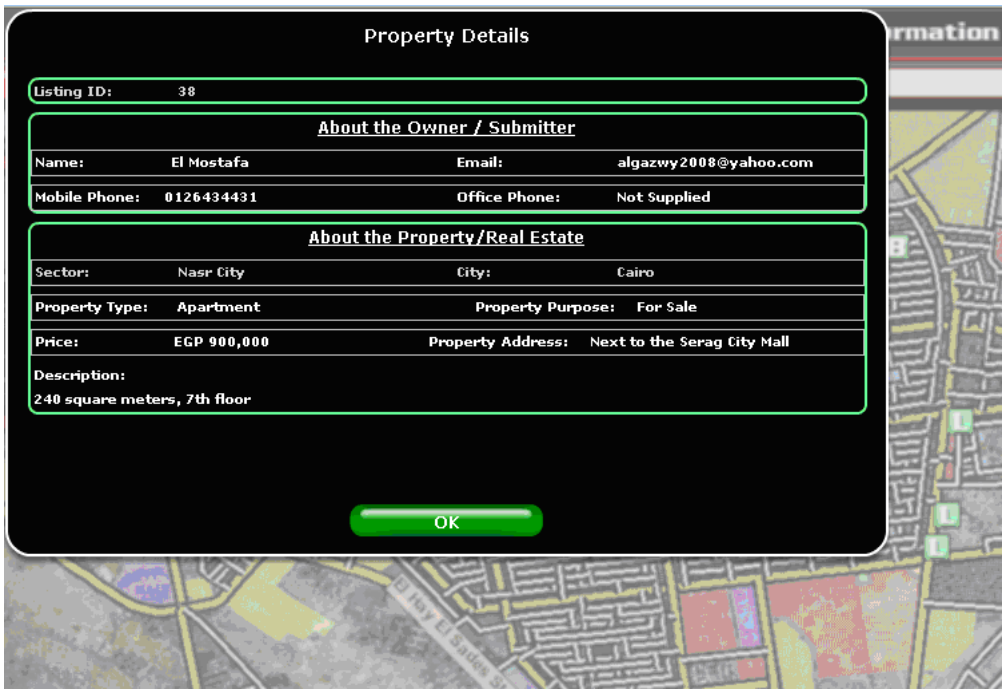

Fig. 7 Interface of main property details that entered by the owner of the unit

Fig. 8 Results of committee's query about the latitude and longitude of the investigated building

Table 1: Comparison between real world criterions and its GIS representation

Real world geographical criterions	GIS representation layer
Roads Network	Line
Road Intersection	Node
Rivers	Line
Garden	Polygon
Public buildings	Polygon
Train Stations/ Ports	Polygon
Water Net Stations	Line
Gas Network Stations	Line
Sewers	Line

Table 2: Difference between traditional manual and novel GIS e-service

Factors	Traditional manual service	GIS E-service
Time	Long time	Less time
Effort	Very High	Very Low