The Panoramic VR Integration of Web-based GIS Residential Property Marketing Information System (WGPMIS)

Eran Sadek Said MD SADEK and Siti Aekbal SALLEH, Malaysia.

Key words: Web GIS, property GIS, marketing GIS

SUMMARY

The emergence of panoramic virtual reality (VR) as visualization tools and acceptance of GIS technology in real estate business have seen to be a major factor of integrating these technologies to increase the marketing efficiency and information dissemination. In Malaysia, most property marketing system be it in residential or commercial property, have utilised tabulated database system and graphics to provide insight about the property and link to google map to allow location based query. This paper presents the integration of panoramic VR and Geo-processing queries of the design and development of the Web-based GIS Residential Property Marketing Information System (WGRPMIS). This system is intended to be integrated with the virtual GIS technology enabling the consumer to virtually explore the potential property upon the multi criteria selection through assisted geo-processing query. The system is built using ArcGIS Desktop 10, ArcGIS Server 10 and ArcGIS Viewer for Flex 3.4. The client-server architecture used for this system is Representational State Transfer (REST) where the client web application is built using Adobe Flex Application Programming Interface (API) through application builder, and customized using Widgets and scripting in Extensible Markup Language (XML). The spatial data features are stored in a Geodatabase and published as Map Service through ArcGIS Server. The base maps are acquired from online web services (Bing, ESRI) and the Animation/Panoramic view of the property is stored in Adobe ShockWave Flash (SWF) file format.

The Panoramic VR Integration of Web-based GIS Residential Property Marketing Information System (WGPMIS)

Eran Sadek Said MD SADEK and Siti Aekbal SALLEH, Malaysia.

1. INTRODUCTION

Housing estates and property industries have become significantly active industry in Malaysia. This has led to a large number of investments from the property developers, contractors, professionals and local authorities. The rapidity of property development results in more choices of houses available. Consumers will certainly become more indecisive towards making a choice. Traditionally, house buying activity involves site visiting and verbal communication between the property seller and buyer. Even though the practice has been successfully implemented for many years, this method is rationally efficient but it requires more time, energy and money. Having known that, some of the property developers and estate agents have taken one step ahead by putting and advertising properties on the road billboard, newspapers, television, posters and even on the web for selling and renting purposes.

The introduction of GIS technology in property management information system has enable users to handle large spatial data and improve the system efficiency. According to Zlatanova (2000), commonly established systems dealing with spatial data are 2 Dimensional (2D) GIS and 3 Dimensional (3D) Computer Aided Design (CAD) system. The CAD system was found to have deficiencies in modelling large models of 3D visualization. These deficiencies can be overcome with the technology such as Virtual Reality (VR) and the improvements of hardware and libraries (Guttentag, 2010; Ma, 2010).

VR is a form of human-computer interface (HCI) that involves the creation based on a reality (Brodlie *et al*., 2002). VR is a computer generated simulation that allows user to interact with data that gives the appearance of a three-dimensional environment, while 3D is a view that provides depth perceptions. Fisher and Unwin (2002), have demonstrated numerous applications of virtual reality in geography (see also Brodlie *et al*., 2002; Kluitmans and Collin, 1991; Gillings, 2002; Haklay, 2002; Kraak, 2002; Batty and Smith, 2002; Ogleby, 2002 and Cheesman and Perkins, 2002). The VR technology such as animation can provide a walk through model of building and construction sites. Animation enables the 3D view to become alive. This can be done by recording actions and replay as desired. The adoption of 3 dimensional GIS (3D GIS) and virtual reality in many studies such as archaeology (Gillings, 2002) and landscape (Lovett *et al.,* 2002 and Brown *et al.*, 2002) are mostly related to visual analysis and interpretation. These components may influence the effectiveness of an information system.

The image-based VR which is also known as panoramic VR allows exploration through 360° from a location. The quality of the image used for the development of the Panoramic VR movie can be very high which depends on the type of camera used. The most common

method used for the production of panoramic movie is multi-photograph and two photograph stitching. Using Multi-photograph method the image quality is very good. However, the vision for seeing the shots directly from above and below from where the shots are taken is hidden or out of sight has becomes the limitation. On the contrary, the two-photograph method, joining the two images together enabling viewing all around including above and below from where the shots were taken. Figure 1 represents the example of the development of panoramic display using photo captures. This figure shows different quality of images used for the constructing of the panoramic views.

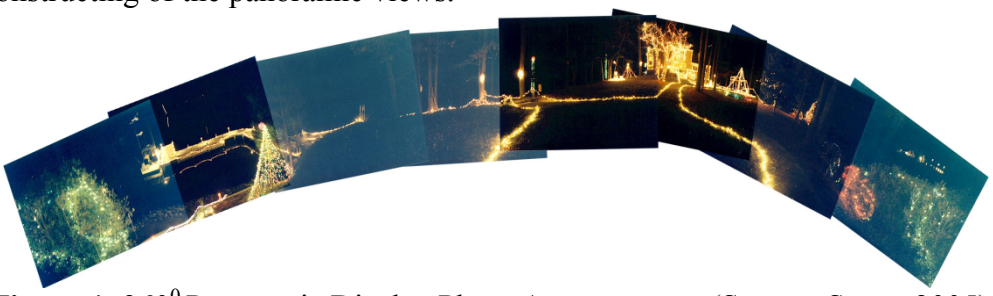

Figure 1: 360^0 Panoramic Display Photo Arrangements (Source: Steve, 2005).

The main weakness of panoramic VR is that the competency of the function for the viewer to navigate within in a Panoramic VR space is not the same as 3D environment have to offer. Panoramic VR is most notably different from traditional 3D implementations of VR by restricting the viewer or the object viewed to one point in space. The viewer cannot navigate in a Panoramic VR space in the way they might in a 3D environment. The benefit of this approach is we can produce photographic quality VR. According to Sherman and Judkins (1992), VR allows you to explore a computer generated world by actually being in it. Figure 2 shows the complete 360^0 panoramic display of Trocadero and Sainte Chapelle, Paris.

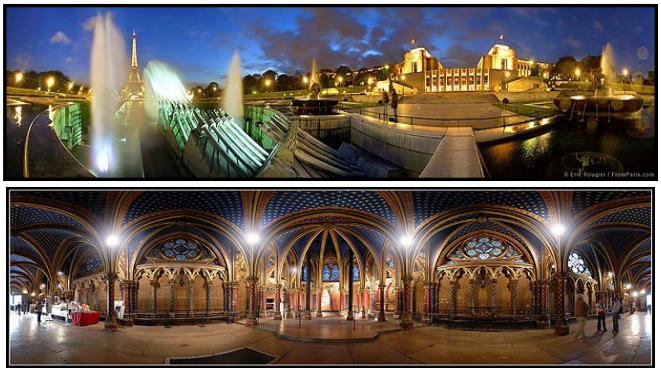

Figure 2: Panoramic Display of Trocadero and Sainte Chapelle, Paris (Source: Rougier, 2005)

Having known that technologies such as GIS, 3D and virtual reality have the capabilities to improve system efficiency, the establishment of the integration of such technologies in the property marketing system could improve and simplify the process of selecting, buying and

selling a property. The time requirements may be shortened and information retrieval could be done effectively.

2. THE SCHEMATICS IMPROVEMENT OF GRPMIS

With refered to the pilot system (Salleh *et al.,* 2008) and improved conceptual design of WGPMIS (Salleh *et al.*, 2014), the following sections outlined the enhancements made of the improved schematic representations of the pilot and improved system.

2.1 The GRPMIS Layout

The schematic diagrams of the user interface described that the user of the system are divided into two groups which are the registered and general users. Once the user log-in as the registered users he/she have the privilege to edit, delete and entry new advertisement of their property. The entered and updated information is also available for the general users to browse and obtain the information. General users are not allowed to perform any editing of the information provided. A user interface should be easy to understand and handle, user friendly and most importantly effective and helpful. The schematic representation of the pilot system is illustrated in Figure 3.

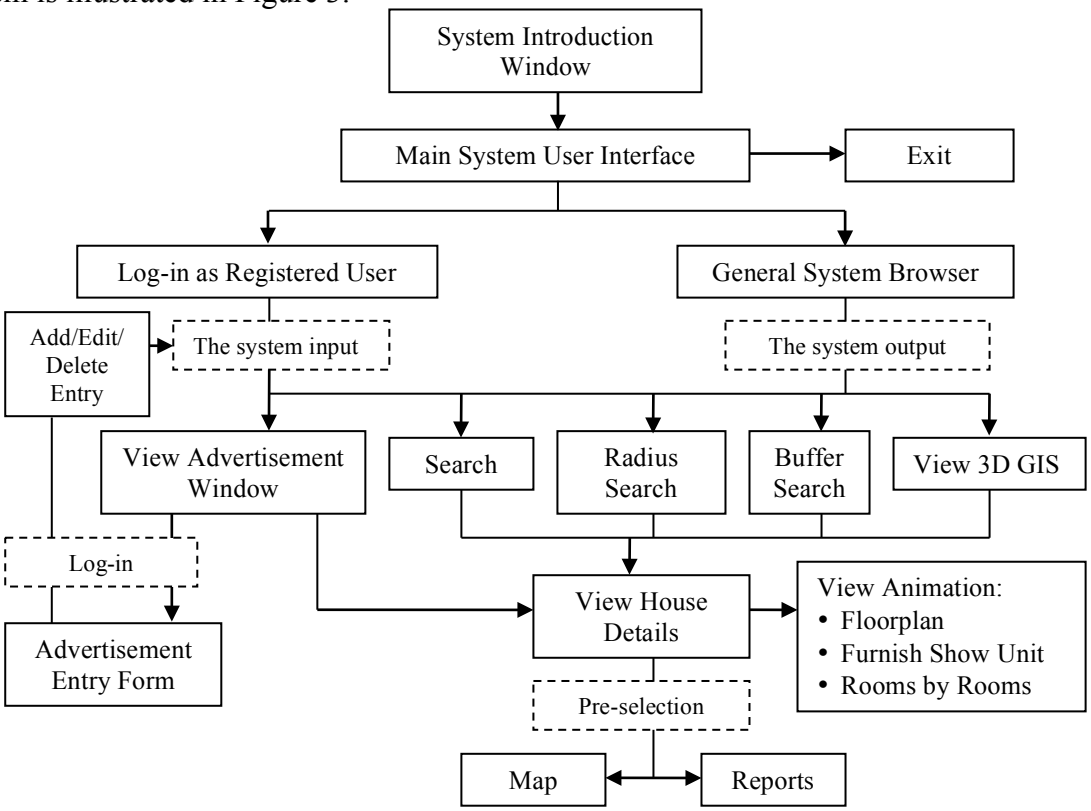

Figure 3: The schematic representation of Pilot System user interface

The pilot system was design and developed based on the construct user requirement study using study of existing systems and direct semi-structured interview with the potential users

of the system (consumers, real estate agents and property developer)(Salleh *et al.*, 2008). The search engine embedded in the pilot system is programmed using Visual Basic, and it has some limitation especially with regards to its networks and geo-processing query results. The initial design of the 3D visualization function in the system was to integrate 3D GIS. One main constraint is whenever the system is compiled, and within the testing environment, the loading of 3D GIS features required more time to complete. Thus, this function is to be reconsidered and simplify alternatives are investigated. Figure 4 shows the result of 3D representation of the tested area. All the functions for general and registered users of the pilot system are summarized in Table 1.

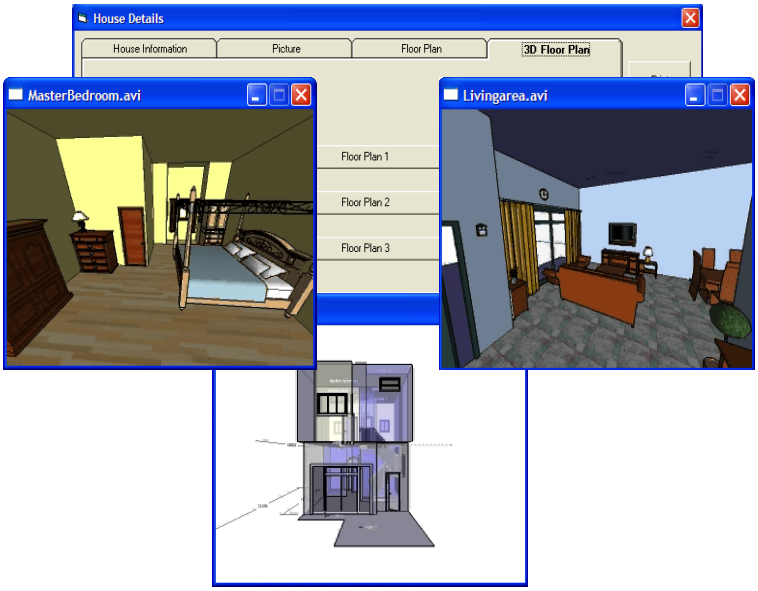

Figure 4: 3D function of the Pilot System (Salleh *et al.*, 2008).

Table 1: The Pilot System Functions (General and Registered)

GENERAL FUNCTIONS	**DESCRIPTION**
Query Search	Search function by query form according to attributes
Buffer Search	Query intended to visualize surrounding area of the selected features within the specify buffer parameter.
Radius Search	Query intended to visualize surrounding area of the selected point of interest within specify radius parameter.
3D GIS View	Viewing housing area in Perspectives View
View Advertisement	View property advertisement
REGISTERED FUNCTIONS	**DESCRIPTION**
Query Search	Search function by query form according to attributes

Buffer Search	Query intended to visualize surrounding area of the selected features within the specify buffer parameter.
Radius Search	Query intended to visualize surrounding area of the selected point of interest within specify radius parameter.
3D GIS View	Viewing housing area in Perspectives View.
View Advertisement	View property advertisement.
Edit Property	Owner/agents can advertise their property and edit or remove their advertisement also edit/update/change their property information.
Manage Property	Exclusively for the system Administrator

2.2 The Improved WGPMIS Layout

This section presents the improved schematic representations of the WGPMIS. Figure 5 illustrates the improved schematics representation of WGPMIS. Major changes were made at the Search functions and 3D visualization function. Here, 3D GIS and VR GIS was replaced with Panoramic VR to increase loading time, simplify the 3D features complexity, reduce the computer processing time and optimized high resolution visualization of the property using image-based.

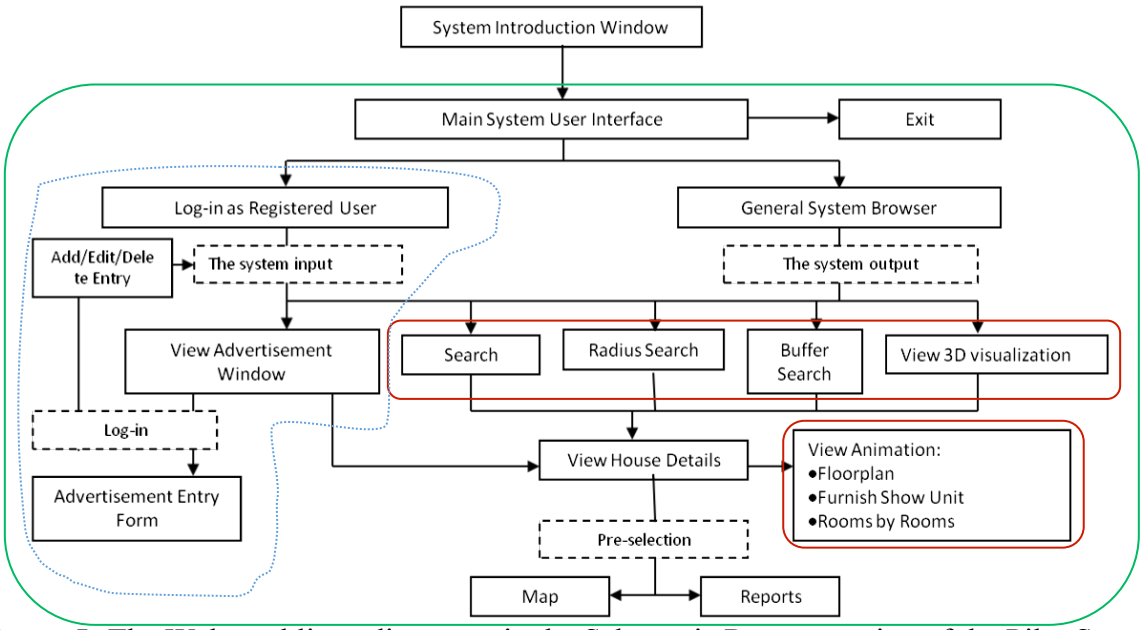

Figure 5: The Web-enabling adjustment in the Schematic Representation of the Pilot System

The overall improvement was mainly focus on the platform to which the system will run. The desktop platform was replaced with the web-based platform, and thus the whole functions starts from the main system user interface until the identified map and reporting require web-

enabling adjustment (green line box). The functions that were marked in red line indicate where the major improvements took placed. While the functions marked in blue line, was not yet improvised as web-enabling functions. Hence, Figure 6 shows the improved schematics representation of WGPMIS.

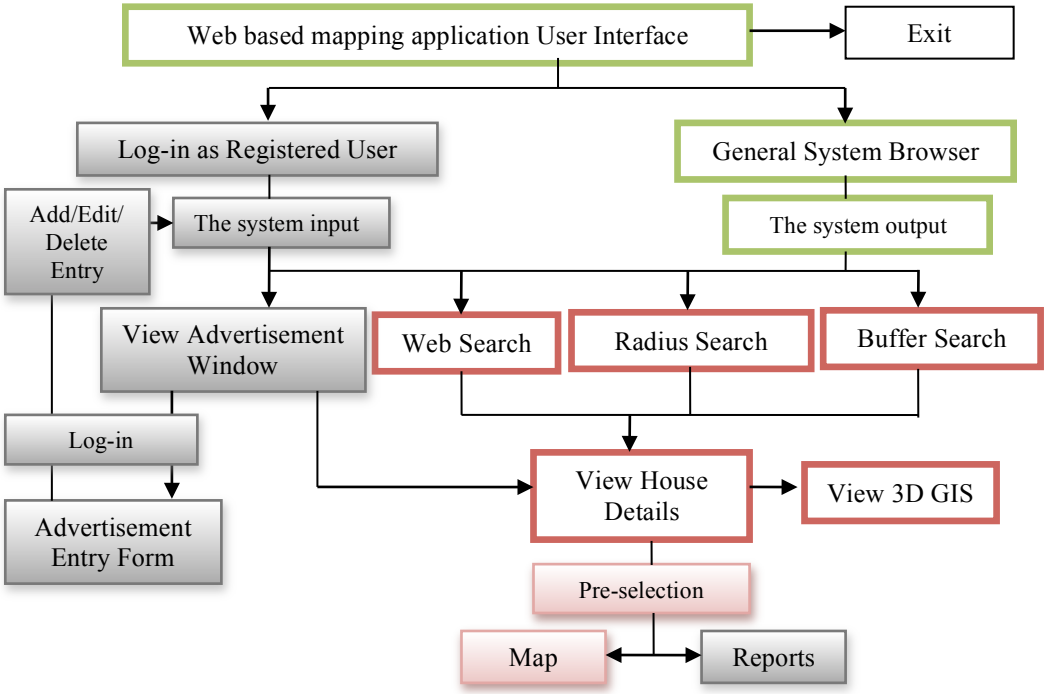

Figure 6: The Schematic Representation of WGPMIS

The functions highlighted in grey colour are still in the web-enabling processes. All the functions marked in red and green line have undergone the web-enabling adjustment. The results are explained in the following sections.

3. THE IMPROVEMENTS IN THE DESIGN AND DEVELOPMENT OF WGPMIS

The web based mapping application was built using ArcGIS Desktop 10, ArcGIS Server 10 and ArcGIS Viewer for Flex 3.4. The features are stored in File Geodatabase and then published as Map Service through ArcGIS Server. The base maps are acquired from online web services (Bing, ESRI) and Representational State Transfer (REST) was used as the Client-server architecture. The Web application is customized using Adobe Flex Application Programming Interface (API) through application builder, and most customizations are scripted using Widgets and Extensible Markup Language (XML). The integration of Animation/Panoramic VR was remarkably easy as it can be stored as Adobe ShockWave Flash (SWF) file format to view the property. The WGPMIS development was essentially based on the conceptual framework illustrated in Figure 7. Figure 8 shows the user interface of the improved WGPMIS where the features as operational layers with interchangeable basemaps.

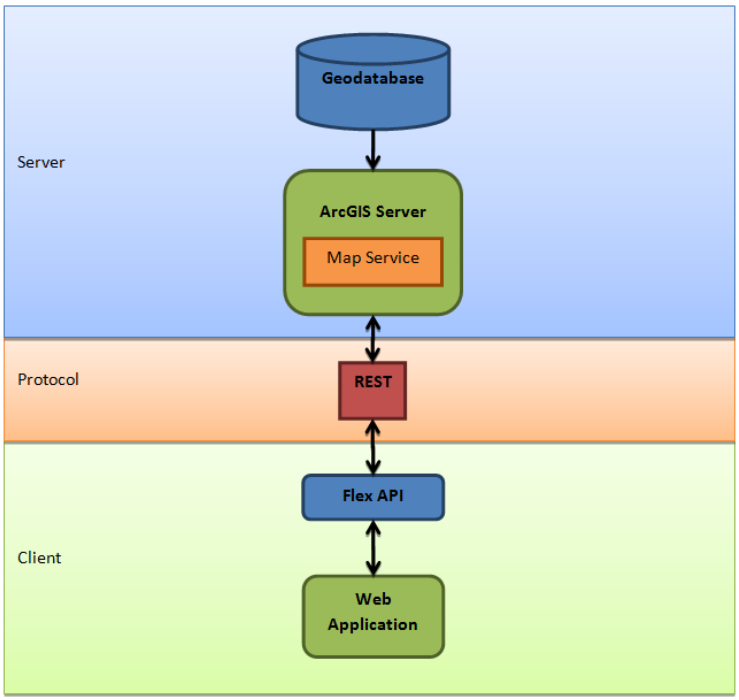

Figure 7: The Web-based Conceptual Framework

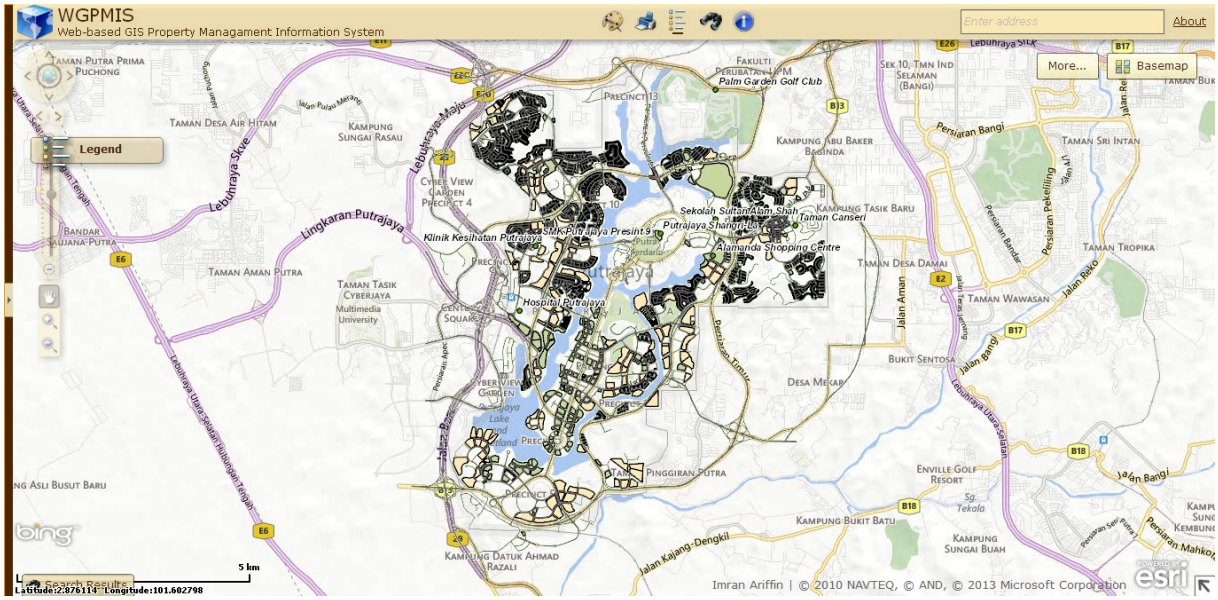

Figure 8: The web application.

The WGPMIS have also upgraded the search interface (see Figure 9). The enhanced search tool allows users to find properties interactively, for example, search within a specified buffer. This buffer search enables users to determine the potential service area within the specified locations.

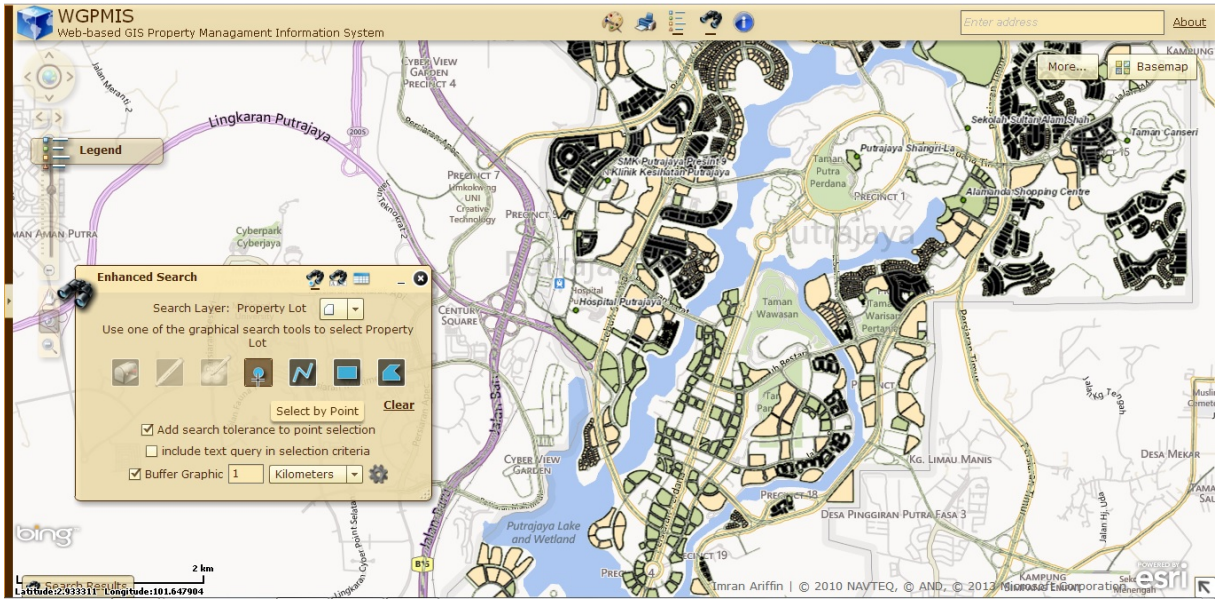

Figure 9: Enhanced Search interface.

Figure 10 shows the result of the buffer search of WGPMIS while Figure 11 shows the query result based on accesibility and road connectivity. If the geodatabase contains attributes, the system's users are able to perform search by property info; such as price, property type, unit type and property name, depending what attributes were provided in the features geodatabase. The option can be seen in Figure 12.

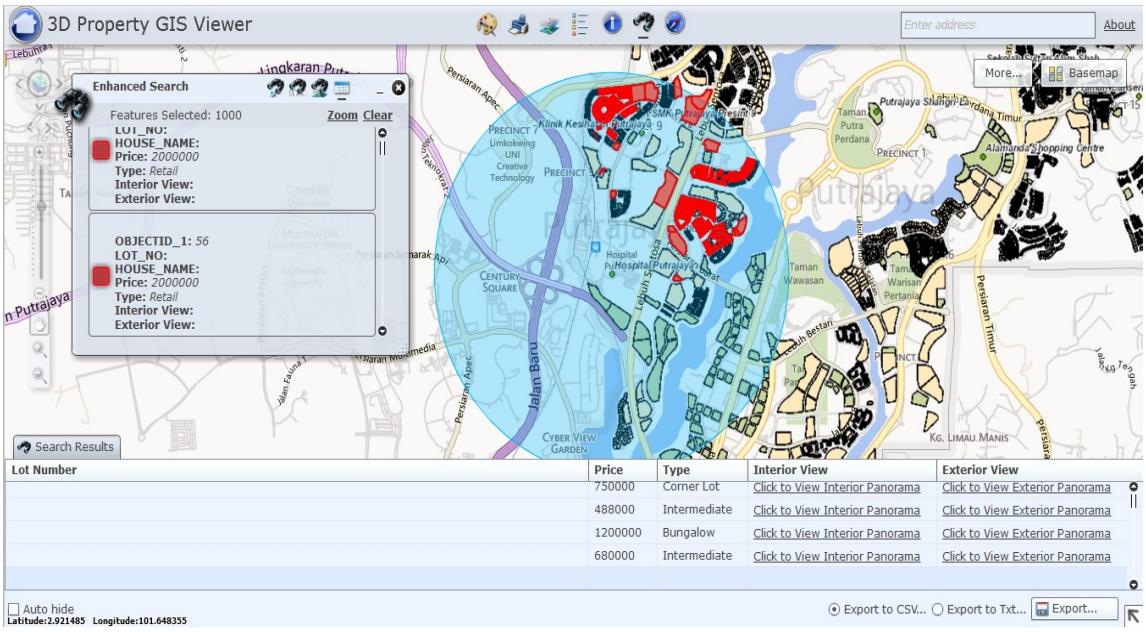

Figure 10: Buffer search result from Selected Points

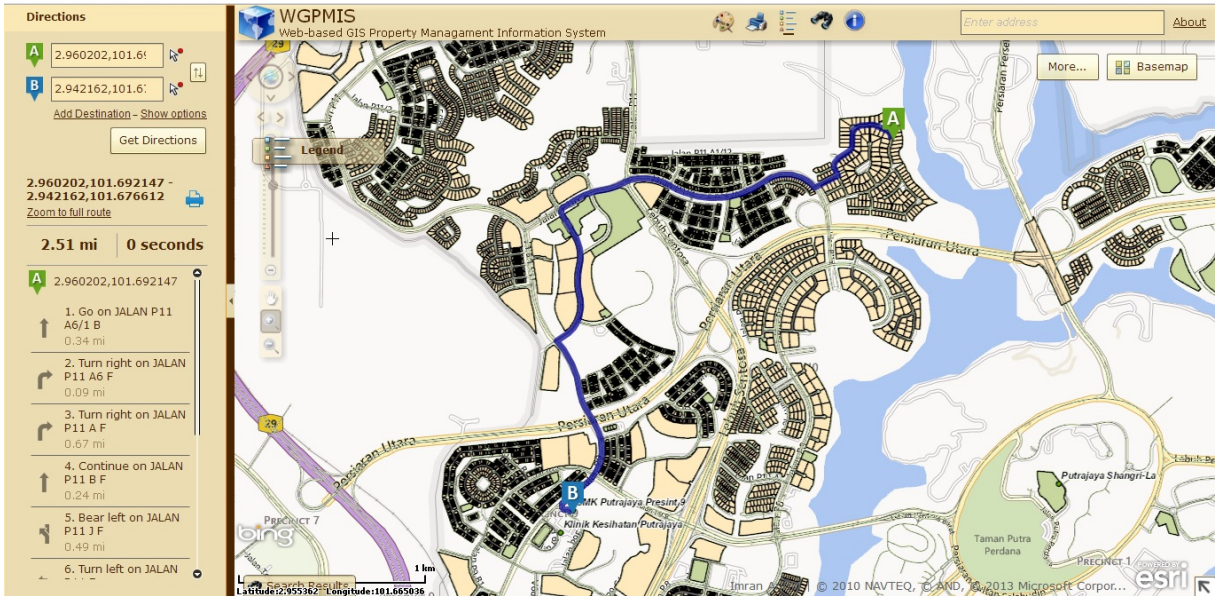

Figure 11: Search result based on Point of Interest (POI).

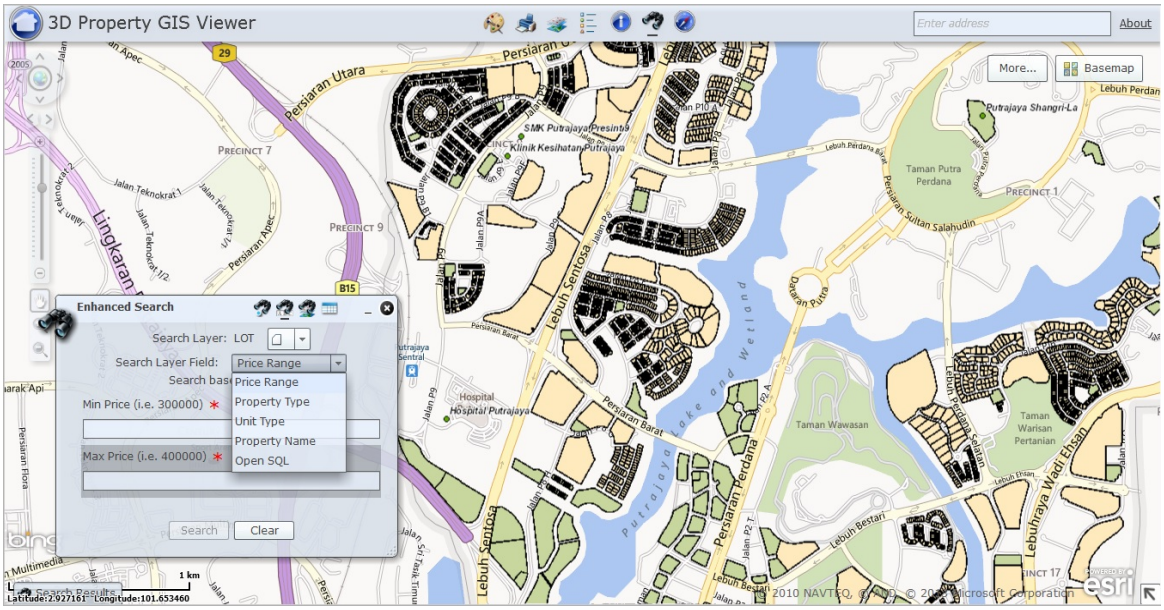

Figure 12: Attribute-based search

Once the user have identified the property with reference to the specified criteria, particular units will be selected. Figure 13 is the example window prompted the identified property. The users are then able to use the information stored in the geodatabase. Users can also view the 'tagged' interior or exterior panoramic view of the feature. As such, it is clearly addressed that this info was uploaded by the property owners, real estate agents or the property developers. Examples of panoramic VR of the residential property can be seen in Figure 14.

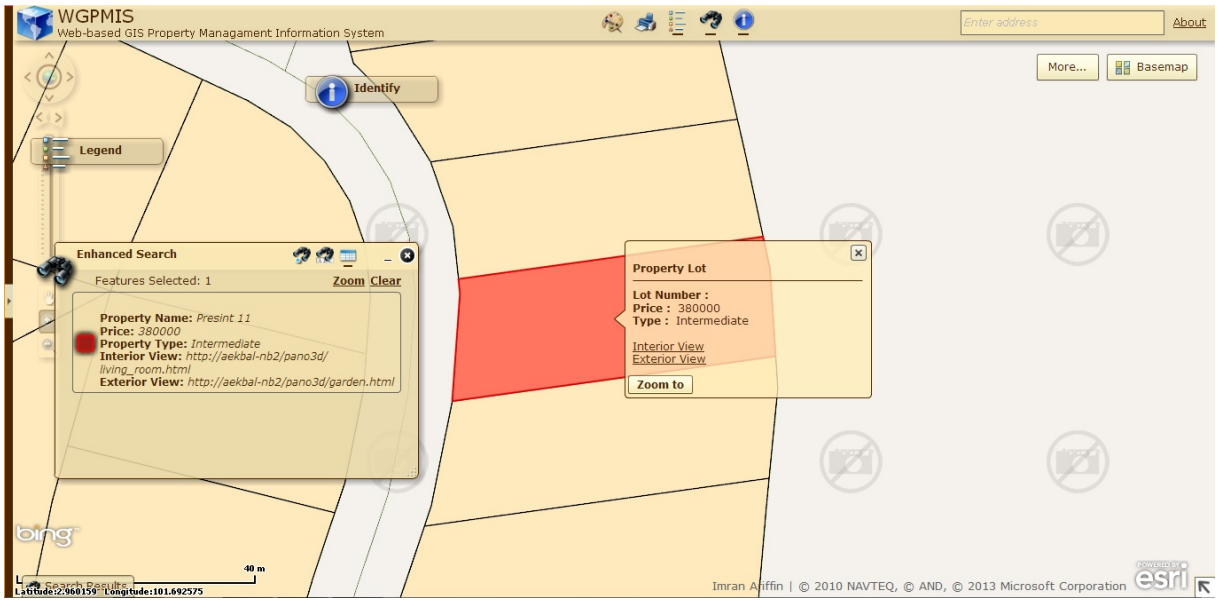

Figure 13: Feature identification

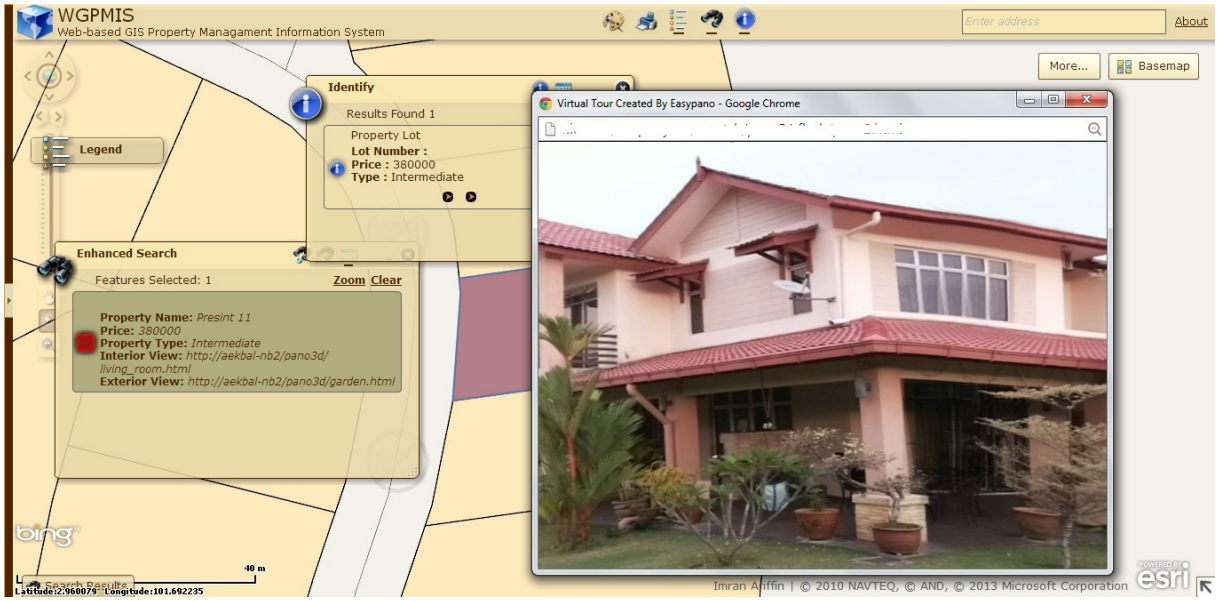

Figure 14: SWF file opens in a new window

4. CONCLUSION AND RECOMMENDATION

This study highlighted numerous potential of panoramic VR and GIS potential that can be integrated into a system. The potential expansion of the Pilot system (GRPMIS) was successfully improved with the capabilities to perform some GIS elements of analysis (geo-processing) within the improved system (WGPMIS). With minimum cost, the improved system are able to view the GIS data layers online with the availability of BING map and

functions are enabled through the use of Representational State Transfer (REST) as client-server architecture. The integrations of panoramic VR has been notably simplified the 3D GIS representations by using the image-based panoramic that offers significantly high resolution of visualization. The web application was mainly built using Adobe Flex Application Programming Interface (API) through application builder, and most customization using Widgets and Extensible Mark-up Language (XML) scripting. With the wide availability of property marketing portal available in Malaysia such as iproperty.com, propertyguru.com.my, myproperty.com.my, thinkproperty.my, adarumah.com and many more, it has a huge potential to be commercialised. It either can be embedded with the existing portal or link to it. The system provides a powerful marketing tools for both the user i.e. seller and buyer. Private seller or estate agent can use the system to promote and advertise their properties in the easiest way while the user can experiencing a new way of finding and exploring their dream houses or property with confidence. Recent development in mobile technologies also enables user to capture the panaromic VR with their mobile device and they can upload to the system easily. This will promote the simplicity use of this system. It is also recommended for future work that such systems to be tested and evaluated by the real users and measures the efficiency of the system. In the future the integration of highly complex systems has to be carried out more cost-efficiently, with a high degree of miniaturization and flexibility for the adaptation to different platforms such as Android and iOS. A possible answer to this challenge is 3D system integration technologies that enable the combination of different optimized technologies with the potential of low cost development through high-yield and multi-functionality.

REFERENCES

Batty, M. and A. Smith, 2002. Virtualities and Cities: Definitions, Geographies and Designs, In Fisher,P. and Unwin, D. (eds) *Virtual Reality in Geography,* New York: Taylor & Francis, pp. 270-292.

Brodlie, K., J. Dykes, M. Gilling, M. E. Haklay, R. Kitchin, and Menno-Jan Kraak, 2002. Geography in VR: context, In Fisher, P. and Unwin, D. (eds) *Virtual Reality in Geography,* New York: Francis & Taylor, pp. 7-16.

Brown, M. I, B. K. David, A. Lovett, M. William, R. D. Miller, R. Purves, J. Raper, M.J Ware and J. Wood, 2002. Virtual Landscapes: Introduction: In Fisher, P. and Unwin, D. (eds) *Virtual reality in Geographical*, New York. Taylor & Francis, pp. 95-101.

Cheeseman, J. and C. Perkins, 2002. Virtual Reality: an Exploratory Tools for Investigating the Cognitive Mapping and Navigational Skills of Visually-Impaired People, In Fisher, P. and Unwin, D. (eds) *Virtual reality in Geographical*, New York. Taylor & Francis, pp. 362-381.

Fisher, P. and D. Unwin, 2002. *Virtual Reality in Geography: Introduction*, London and New York, Taylor & Francis.

Gillings, M., 2002. Virtual Archaeologies and Hyper-real: or, what does it mean to describe something as virtual-real? In Fisher, P. and Unwin, D. (eds) *Virtual reality in Geographical*, New York. Taylor & Francis, pp. 17-34.

Guttentag, D. A. 2010. "Virtual reality: Applications and implications for tourism," *Tourism Management,* vol. 31, pp. 637-651.

Haklay, M.E., 2002. Virtual Reality and GIS: Applications, Trends and Directions, In Fisher,P. and Unwin, D. (eds) *Virtual Reality in Geography,* New York: Taylor & Francis, pp. 47-57.

Kluijtmans, P. and C. Collin, 1991. 3D Computer Technology for Environmental Impact Studies, *Proceedings of Second European Conference on Geographical Information Systems*, Brussels, Belgium, April, pp. 547-550.
Kraak, M. J., 2002. Visual Exploration for Virtual Environment, In Fisher,P. and Unwin, D. (eds) *Virtual Reality in Geography,* New York: Taylor & Francis, pp. 58-67.
Lovett, A., R. Kennaway, G. Sunnenberg, D. Cobb, P. Dolman, T. O'Riordan and D. Arnold, D., 2002. Visualizing Sustainable Agriculture Lanscapes: In Fisher, P. and Unwin, D. (eds) *Virtual reality in Geographical*, New York. Taylor & Francis, pp. 102-130.
Ma, C., Chen, G., Han, Y., Qi, Y., & Chen, Y., 2010. An integrated VR–GIS navigation platform for city/region simulation. *Computer Animation and Virtual Worlds, 21*(5), 499-507.
Ogleby, C., 2002. Virtual World Heritage Cities: The Ancient Thai City of Ayutthaya Reconstructed, In Fisher, P. and Unwin, D. (eds) *Virtual reality in Geographical*, New York. Taylor & Francis, pp 239-256.
Rougier, E., 2005. From Paris Website, http://fromparis.com/, date extracted: June 2006.
Salleh, S.A., Wan Mohd, W.M.N., Nawawi, A.H., & Md Sadek, E.S.S. (2008). The Integration of 3D GIS and Virtual Technology in the Design and Development of Residential Property Marketing Information System (GRPMIS). *Computer and Information Science, 1*(4), P37.
Salleh, S. A, Wan Mohd W.M.N and Md Sadek, E.S.S, 2014. Improved Conceptual Design of Web-based GIS Residential Property Marketing Information System. Lecture Notes in Geoinformation and Cartography. In Abdul Rahman, A., *et al*. (eds) *Geoinformation For Informed Decisions.*
Sherman, B. and P. Judkins, 1992. *Glimpses of Heaven, Visions of Hell: Virtual Reality and its implications*, Hodder and Stoughton: London.
Steve, T., 2005. Steve Tacky Light Website, http://christmas.coastalsteve.com/pics01/, Date visited: 15 March 2006
Zlatanova, S., 2000. *3D for Urban Development*, Thesis for Doctor of the Technical Science, Graz University of Technology.

BIOGRAPHICAL NOTES

Eran Sadek Said MD SADEK is Senior Lecturer at the Center of Studies Surveying Science and Geomatics, Faculty of Architecture Planning and Surveying, Universiti Teknologi MARA, Shah Alam, Malaysia. He has Bachelor Degree in Surveying Science and Geomatics, Universiti Teknologi MARA, Malaysia, MSc in Geographic Information Science, University of Nottingham, UK and PhD in Geography (Physical), University of Leeds, UK. His main research area revolves around the use web technologies and 3D visualisation to solve geographical problem. He is a member of Center for Geospatial Technology (UiTM), Applied Remote Sensing and Geospatial Research Group (UiTM), and Royal Institution of Surveyor Malaysia (RISM).

CONTACTS

Dr Eran Sadek Said Md Sadek
Center of Studies Surveying Science and Geomatics,
Faculty of Architecture Planning and Surveying,
Universiti Teknologi MARA,
40450 Shah Alam,
MALAYSIA
Tel. +60355444517

Fax +60355444545
Email: eran@salam.uitm.edu.my