

PANORAMIC IMAGE INTEGRATION WITHIN A WEB-BASED GIS APPLICATION

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ABSTRACT:

This study focuses on the integration of panoramic photographs and web-based GIS. The integration of complementary technologies provides more powerful results in GIS applications. Collecting and assembling a series of digital images of large geographic areas into single panoramic images allow the user to view a multi-dimensional map that provides significantly more geographic information. By adopting the web as a dissemination way for geographic information, we can provide alternate representations of our environment. GIS, which include historical monuments, is important theme for various field such as historical conservation and tourism fields. The GIS published via Internet so as to come into contact with wide-range user. Because of gaps between providers and users, a lot of problems arise on historical heritage especially. The Internet is a perfect solution to speed up interactive communication between them. Panoramic Imaging is a major part of the image-based category of the virtual tours. It provides not only increased realism but also inexpensive solutions to information systems.

Digital Camera was used in order to create Panorama. Beauty spots were chosen in historical place so as to show its visual features. To determine coordinates of point, where photos were taken, were measured by handheld GPS. As a result, a Historical Information System (HIS) was designed and panoramic image was transferred to HIS as a new document. The study is considered as a multi-purpose though; it is capable of serving as an expert system.

1. INTRODUCTION

1.1 Web-based GIS

Recently, there has been new trend in developing Web-based GIS applications. Researchers in this field have recognized Web-based GIS applications are becoming an important tool to disseminate geographical information on the Internet because of their platform independence, interactivity, and wide accessibility (Hu 2002). Geographic information can be distributed in a variety of forms on the Internet. In dynamic maps, the web server will be connected to a GIS, which is able to generate maps on request. They enable to choose features that will be displayed, such as the scale, location values etc. In this type of applications, maps are drawn according to preset parameters. And then the web browser displays the map as an image (Garagon 2002). Figure 1 shows detailed architecture of connection via internet.

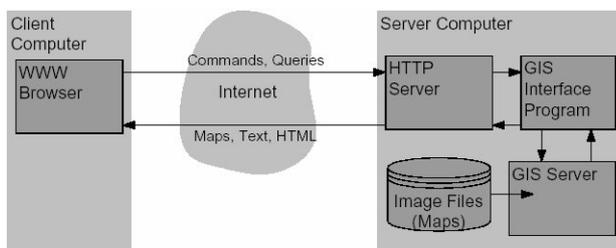


Figure 1. Architecture of Dynamic Configuration (see Plewe 1997).

1.2 Panoramic Imaging

Panoramic imaging is an effective tool to represent environment. Its visual features are very successful. Panorama creates virtual reality well because photographs are used. Image-based virtual reality has more advantages than model based. It can be obtained by a panoramic camera or an ordinary digital camera. Though some problems occur, an ordinary camera is an inexpensive choice.

Although panoramic images are two dimensional as they are constructed from a series of photographs, the effect is considerable realism (Cohen, 2000).

By exploiting panoramic images we are able to generate relatively inexpensive yet convincing walk through representations of complex facilities which support ad-hoc measurements. These image archives are very rich source of information about the true operational status of a facility and thus are already a very valuable component of any FM database (Chapman D., Deacon A., 1998).

Most problems have been debugged by robust matematic models. An image squence can be stitched easily. Some mesaurement techniques are still discussed in computer vision and digital photogrammetry. Panoramic imaging is also useful on the internet. A lot of visual introduction is done by cylindrical or sphere panoramas on the internet.

Panoramic imaging is a suitable documentation method for information system. Nevertheless, panoramic images need more research work to obtain measurements from them. Therefore, a new dimension can be add to georeference of information

systems. So, an information system can be produced more effectively (Akcaay O., Altan M.O., 2003).

The study just indicates semantic power of panoramas. A Web-based GIS application utilizes panoramic images so as to represent historical sites effectively. Especially, while introducing historical monuments, panoramic imaging provides great opportunity to visualize their inside and outside.

2. CASE STUDY

2.1 Study Area and Data

Fatih (Zeyrek) district of Istanbul, Turkey was selected for the case study because it is one of the oldest settlements of the city.

Fatih is situated at the slopes of the fourth hill in the Historic Peninsula in Istanbul. The district starts at the shores of the Golden Horn-Haliç, and extends up the slopes along the Atatürk Boulevard. Retaining walls reaching up to 15 meters are to be found at some spots along the Atatürk Boulevard, as well as dykes and terraces dating from the Byzantine period. These structures present an interesting view in the direction of Galata, Golden Horn, and the Historic Peninsula. (Gülersoy, 2001).

In this study the monastery of Christ Pantepoptes (Eski Imaret-i Atik Cami) in Fatih was selected to sample building for the case study. Figure 2 show the sample building and study area.

The monastery of Christ Pantepoptes is known to have been either founded or renovated by Anna Dalassena, mother of Alexius I Comnenus (1081-1118). Built on the summit of the City's fourth hill, above the underground cisterns, it commands a magnificent view of the Golden Horn and the Bosphorus. The location explains the name Pantepoptes, i.e. the All-Seeing. The church is of the cross-inscribed type with four columns supporting a dome. Its ground plan is that of a three-aisled church with two narthexes. Though in a state of neglect, the elegantly proportioned building has retained the fine decorative brick work of the exterior, the shallow niches, the arches framing single or triple windows, the arcade of the gallery on the west side, the meander and rosette friezes, as well as sections of the cornices carved with palmettes.

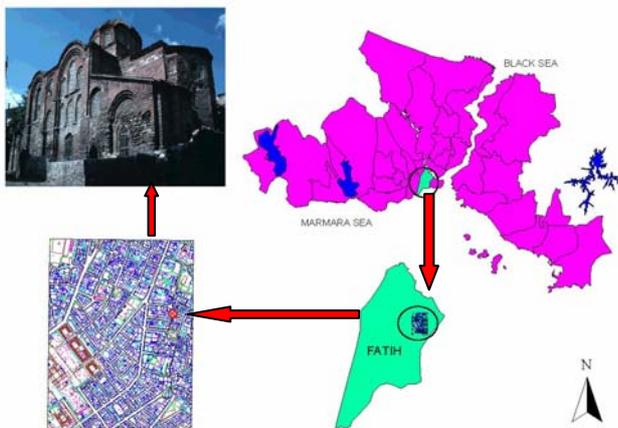


Figure 2. The sample building and study area.

The graphical and geometrical data generated from digital maps and other graphical external files (like digitized plans, amateur photographs etc.) and the alphanumeric data related to the graphical data were linked and managed together by the GIS

software Arc View 3.2 for creating a geographic information system. In this study, Arc/Info GIS software has been used for the establishment of topology of the coverage, which is the basic unit of storage. Then the coverage has been imported to Arc View software for several query and analysis advantages (Duran, 2003).

Digital data in dgn format have 25 different layers. These digital data were transferred into AutoCAD file format and the number of these layers reduced in AutoCAD. The main layers are shown in Figure 3.

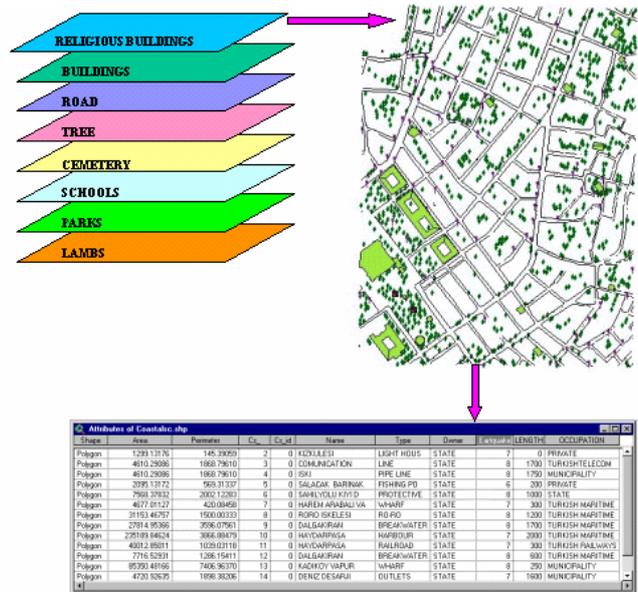


Figure 3. Data structure

2.2 Panoramic Image Acquisition

Panoramic images were built and georeferenced in several steps:

- 1) Photographs were taken outside historical monuments.
- 2) Points in which photos taken were measured by handheld GPS.
- 3) Panoramic images were built on computer. Then they were exported to small size video images.
- 4) Points measured by GPS were georeferenced at Historical Information System (HIS) as node graphic data.

Pantepoptes outside was chosen for panoramic images. To build panorama, Olympus C-4040 digital camera, and a tripod were used. Trial version of 3dvista studio was also used as software. While photograph point was chosen, we paid attention to catch best view best point. So different aspects of Pantepoptes could have been showed at panoramic images.

Two points could have been just chosen as panoramic images due to narrow area around the mound. 360⁰ degree view was gotten in the each point. Approximately eight or ten photographs were taken so as to get pure each panoramic image. Preceding image overlapped following image at most 50%. Therefore, a cylindrical panorama was obtained. Figure 4 illustrates structure of cylindrical panorama.

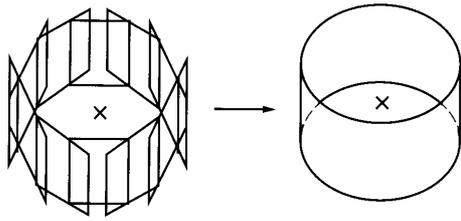


Figure 4. Cylindrical panorama (see Benosman, R., Kang, S.B., 2000).

Since panoramic image becomes larger than each image used for creating panorama, picture size should be very low. For instance, if an image size is 40 kb, total panoramic image is about 400 kb. 400 kb are even a high size on the internet because end user's connection problems. When we make size of image small, we lose the visual quality.

Pictures were opened at 3dvista Studio by order. After alignment and stitching process, we got panorama. Panoramic image was converted to a video file (Figure 5). The file extension is mov. It's well-known file format for Quick Time Player. So we managed to convert an image file to video file. It gives opportunity to use easily because of common video file format. End users don't encounter any problem to play the movie file. (Akçay O., Altan M.O., 2003).

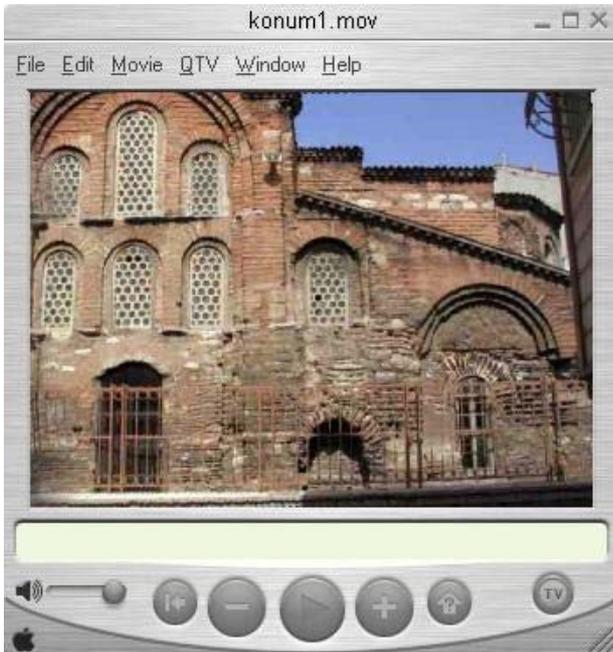


Figure 5. A video image (panoramic)

Points taken photos in, also were measured by handheld GPS because of determining coordinates of panoramic images. After measurement with handheld GPS, we obtained WGS-84 datum geographical coordinates. The coordinates should have projected to 3 degree Gauss-Kruger Cartesian coordinates. Table 1 and Table 2 illustrate coordinates and projection result for GPS measurement.

Point No.	East	North
N.1	28° 57' 19".4	41° 01' 22".1
N.2	28° 57' 18".8	41° 01' 22".1

Table 1. WGS-84 coordinates obtained from GPS

Gauss-Kr. Cartesian Coord.	Y (m)	X (m)
N.1	4 543 669.880	412 131.010
N.2	4 543 710.820	412 141.470

Table 2. Gauss-Kruger Cartesian Coordinates

Figure 6 explains how to provide integration between panorama and GIS. Perspective view of Historical peninsula is showed in Figure 6. According to measured point, panorama was located to information system.

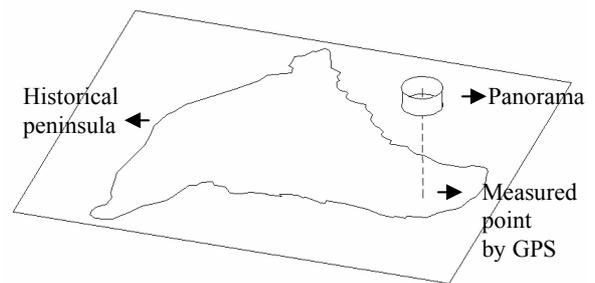


Figure 6. Integration of Panoramic Image

Location was done with Arcview software. Therefore, panorama was obtained as data.

2.3 Integration with Web-based GIS

In the study, Map Objects ActiveX software component and Map Objects Internet Map Server software (ESRI) were used. Map Objects was used to build the GIS application and MOIMS was used as a gateway program. Map Objects and MOIMS were used together with Visual Basic, which is an application development environment. Microsoft Internet Information Services Program was used to share information over the Internet. Figure 7 and figure 8 shows samples of internet application from browser.

3. CONCLUSIONS

Web-based GIS applications combine the advantages of both GIS and the Internet. Linking spatial data with panoramic images and other non-spatial data has a potential for environmental management, urban planning, preservation, and tourism. There will be subsequent improvements in the functions and capability of the application to make it more efficient.

4. REFERENCES

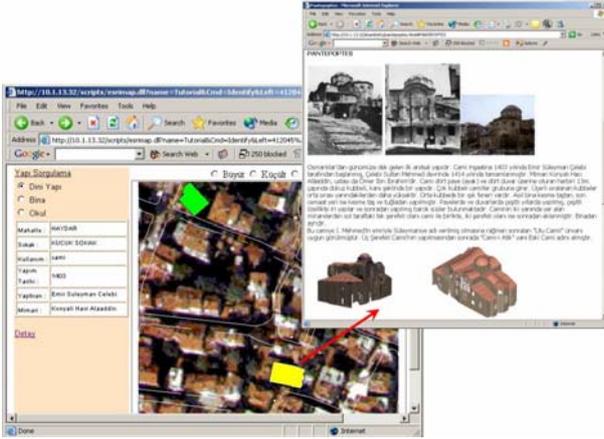


Figure 7: Query Results and Detailed Information for Pantepotes.

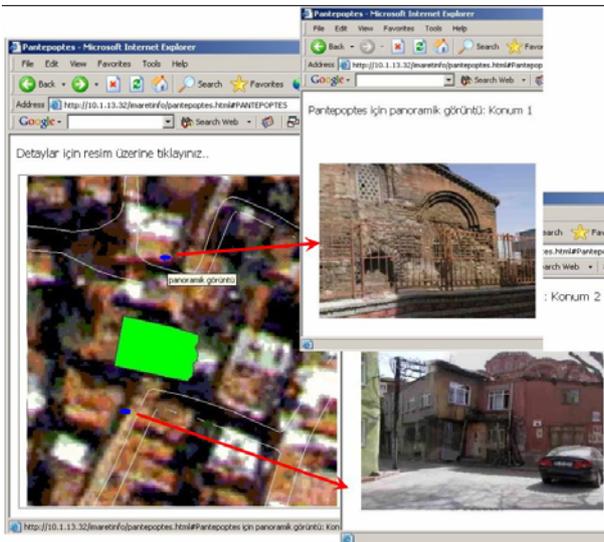


Figure 8: Panoramic Image Display on the Internet.

Though panoramic imaging is a good way to visualize the environment, there are some obstacles. For instance, narrow streets are not convenient for the outside visualization of Pantepotes by panoramas. Panoramic images are more effective if objects are far away from camera. Both close range and remote objects make the video images less effective for visualisation in the view. They should not be in the same video.

Hotspots on the panoramic images can be useful for virtual walking among the historical sites. In the next study hotspots will be added.

Handheld GPS gives us low accuracy coordinates. While panoramic images are taken, GPS measurement methods which have more accuracy should be used. However handheld GPS saves time, despite of losing accuracy. In fact, choosing measurement method depends on the aim of the study.

Akçay, O., Altan, M.O., 2003. Design of a Tourist Information System (TIS) and Integration with a Panoramic Imaging, *CIPA 2003 XIXth International Symposium-New Perspectives to save cultural heritage p.157-160*, Antalya.

Benosman, R., Kang, S.B., 2000 *Panoramic Vision. Pspringer-Verlag Newyork, Inc.*

Chapman D., Deacon A., 1998 *ISPRS Journal of Photogrammetry & Remote Sensing 53 pp.311-319.*

Cohen, G., 2000 D., Communication and Design with the internet *W.W. Norton and Company, New York, London.*

Duran, Z., 2003, Documentation of Cultural heritage by means of Photogrammetry and GIS, *PhD Thesis, ITU.*

Garagon, A., et al. 2002. Interactive Earthquake Information on the Internet. In: *International Symposium on GIS, Turkey.*

Gülersoy, Z., N., Tezer, A., Yiğiter, R., Ahunbay, Z., 2001, Zeyrek a Study in Conservation, Istanbul Technical University, Faculty of Architecture, Istanbul, Pp. 37-38.

Hu, S., 2002. Web-based Multimedia GIS for the Analysis and Visualization of Spatial Environmental Database. In: *Symposium on Geospatial Theory, Processing and Applications, Ottawa.*

Plewe, B., 1997. *GIS Online: Information Retrieval, Mapping and the Internet. OnWord Press, Santa Fe, NM.*