WEB-BASED MULTIMEDIA GIS FOR HISTORICAL SITES

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ABSTRACT:

With the recent developments in web-based GIS applications, the process of accessing, sharing, disseminating and analyzing data has changed. Web-based GIS uses the Internet to access and transmit data and the analysis tools to enhance the visualization and integration of spatial data. Multimedia GIS also allows the users to access a wide range of multimedia data. Integration of web-based GIS and multimedia provides the users the tools to analyze and visualize both spatial data and associated multimedia data on the Internet. The aim of this study is to develop and operate a web-based multimedia GIS application for a historical site. In this study, data acquired from different sources were compiled by using GIS software's, a GIS application was developed, and a web site was configured to serve the system on the Internet. Linking spatial data with multimedia information facilitates the inventory, evaluation, and preservation of historic sites. By means of this study, the various type of collected information can be disseminated to end users (i.e., planners, managers, and public) with low technological requirements.

1. INTRODUCTION

Multimedia is a technology that encompasses various types of data and presents them in an integrated form. There are several types of data that are used by the technology, including text, graphics, hyperlinks, images, sound, digital and analogue video and animation.

Although many GIS have been successfully implemented, it has become quite clear that two-dimensional maps cannot precisely present multidimensional and dynamic spatial phenomena. Moreover, there is a growing need towards accessing spatial data. It seems that merging GIS and Multimedia is a way to deal with these issues.

The latest advances in computer industry especially in hardware have led to the development of the Multimedia and Geographical Information System (GIS) technologies. Multimedia provides communications using text, graphics, animation, and video. Multimedia GIS systems is a way to overcome the limitations displayed by the technologies when they are used separately. Multimedia can extend GIS capabilities of presenting geographic and other information. The combination of several media often results in a powerful and richer presentation of information and ideas to stimulate interest and enhance information retention. They can also make GIS more friendly and easier to use. On the other hand, multimedia can benefit from GIS by gaining an environment which facilitates the use and analysis of spatial data. The result is a system, which has the advantages of both worlds without retaining most of their disadvantages.

The primary focus of this study is the inventory, evaluation, preservation, and documentation of historic structures and sites. GIS greatly facilitates the mapping, recording, and management of spatial and non-spatial historical data. In order to determine significance of historic structures, a historical structures database was developed. Information about these buildings is entered into the database; it is linked to the GIS. Then, a historical structures web page has been posted on the Internet. This web page provides the current status of historical buildings and connects to multimedia tools. Access to this web page allows users to obtain the most recent information pertaining to historic structures. Some structure's status is featured on its own page with links to multimedia tools such as photos, video, maps, 3D models, and CAD models and also related textual information.

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. Zeyrek is situated at the slopes of the fourth hill in the Historic Peninsula in Istanbul (Gülersoy, 2001).

Data were provided from Municipality of Metropolis Istanbul in the scale of 1:1000 digital maps and at Micro Station file format (dgn). These digital data were transferred into AutoCAD file format and the number of these layers reduced in AutoCAD. ESRI Arc View software was used for browsing the data and examining the datasets. (Duran, 2003). Attribute information of the features such as name of the quarter, name of the street, number of the door, functionality of the building, basement, medium floor, roof, total floor, condition of the building, registration, name of the building, construction date, financer, style of the building etc. were stored in the database table. Data processing is displayed in **Figure 1**.

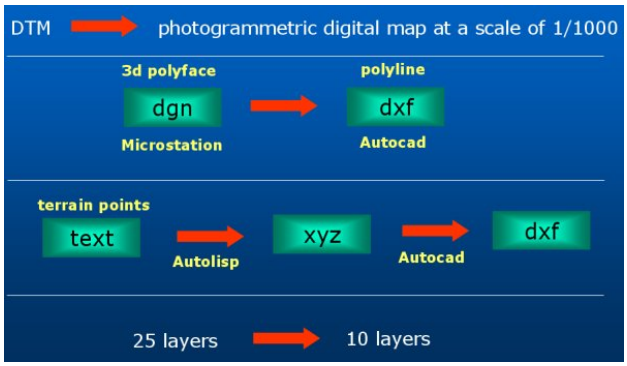

Figure 1: Data processing.

In the past digital terrain models (DTM) and geographic information systems (GIS) were developed isolated from each other. Both tools exist for about 30 years. The applications of today require more and more the three-dimensional reference surface for GIS, although temporary aspects demand for four dimensions including time as additional reference parameter.

Most applications nowadays use 2D GIS for display, storage and analyses. But many applications require a model of the surface to calculate the height or the slope at certain points. Many GIS have additional terrain modellers to make use of height data in form of a regular grid or a triangulated irregular network (TIN).

To add a digital terrain model to a GIS results only in a 2.5D GIS because it is not possible to model a solid. A simple and convenient way is to add descriptions of man-made objects like buildings to planimetric objects and attaching them to the surface. In CAD applications different solid models are available. 3D GIS may thereby provide a more realistic representation of the modelled world. Some draw-backs are more expensive data management and the problem of data acquisition. Normally you can only expect to extract the (average) height of buildings and not an exact reconstruction of the building (Fritsch and Schmidt, 1995).

We have two kinds of databases: the one who has the graphical and geometrical data and the other who has the alphanumeric data related to the graphical data. The first one will be generated from the photogrametric digital system or from other graphical external files (like digitized plans, amateur photographs etc.). The second one will be handled with the DBMS ACCESS. Both databases will be linked and managed together by the GIS software Arc View 3.2, creating the information system.

Objects are being built by linking spatial data (point, lines or polygons that are defined by geometry and topology) with non-graphic information in GIS. Coverage, also called as layer, is the basic unit of storage in Arc/Info. In this study Arc/Info has been used for the establishment of topology of the coverage. Then the coverage has been imported to Arc View software. This software has been produced as a vector based GIS but also it has limited use of raster base data as well. In addition to several querying and analysis advantage, the result of these attributes.

Digital data in Dgn format has 25 different layers. These digital data were transferred into AutoCAD format and number of these layers reduced in AutoCAD (Duran and Toz, 2002).

Also some of non-topographic information for feature (attributes) such quarter name, street name, door number, building functionality, basement, medium floor, roof, total floor, building condition, registration, building name, construction date, financer, architecture etc. were stored in the database table. Afterwards digital terrain model (DTM) of study area was being produced and captured with orthophoto in Arc View software. This model is shown **Figure 2**.

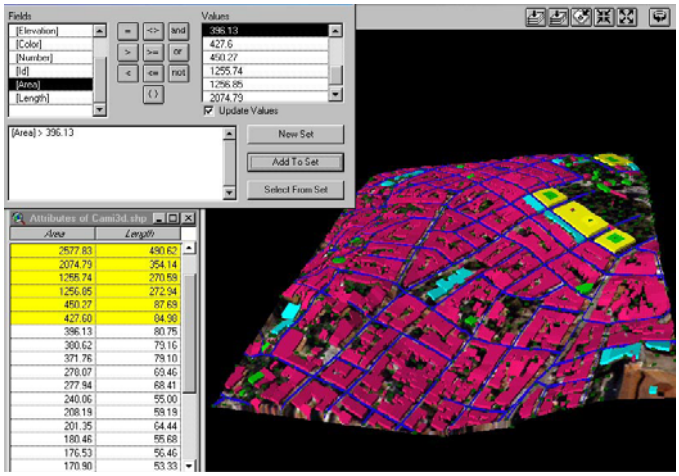

Figure 2. DTM of study area captured with orthophoto and, showing part of attributes table for the monastery of Christ Pantepoptes

Multimedia refers to the use of computers to deliver information using a combination of media types such as text, graphics, audio, video, and animation. Multimedia GIS on the internet provides the comprehensive documentation and management of cultural heritage. Multimedia GIS based on Web allows the user to access a wide range of geo referenced multimedia data (e.g., simulations, images, and videos) (Prakash, 1998). **Figure 2** displays data from different sources including multimedia data are stored into the database.

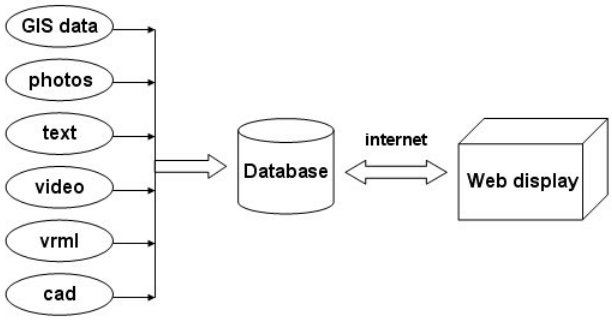

Figure 2: Different kinds of data from various sources into database.

VRML for visualising in 3D offers a platform and software independent file format. Users can easily interact with a 3D model in this form, walking or flying around it. VRML can also be viewed on the web. In this study, Cosmo VRML plug-in which is available free was used. Virtual reality model of the area is shown in **Figure 3**.

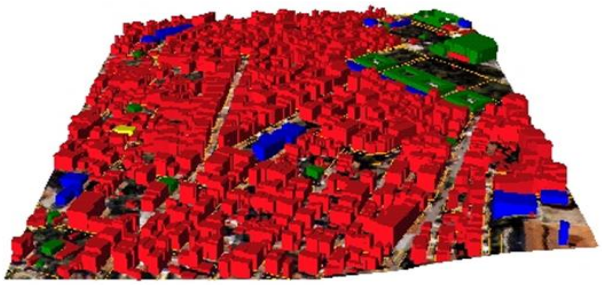

Figure 3: Virtual reality model of the study area.

2.2 Web integration

In the application, the user sends the map parameters over the Internet, and the map image is formed according to the setting parameters. In **Figure 4,** the architecture of the application is shown.

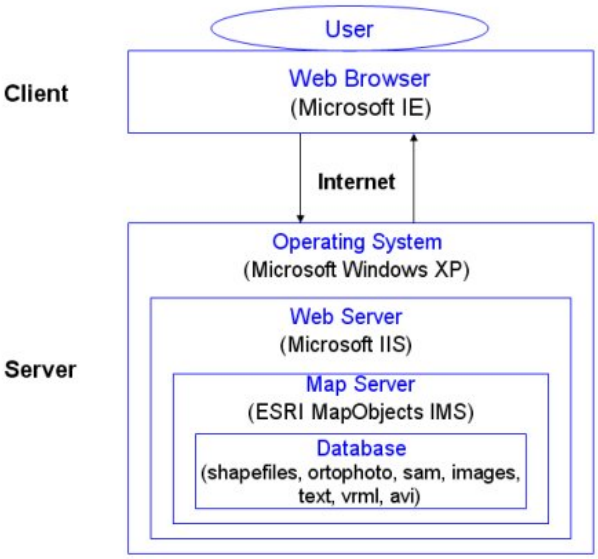

Figure 4: Architecture of web-based multimedia GIS application.

Map Objects ActiveX software component and Map Objects Internet Map Server (MOIMS) software were used in the study. Map Objects builds GIS application and MOIMS is a gateway program between Web Server and the mapping application (Garagon, 2002). These tools were embedded into a Visual Basic file. All map layers and functions on the web page were added by writing codes in the Visual Basic. Microsoft Internet Information Services program was used for information sharing over the Internet. **Figure 5** shows the application on the Web.

The web page contains an interactive map container, which displays the map layers, a toolbar column, which is used for querying buildings, and a legend column, which is an explanatory table of the map features. Users can use the map interactively by performing GIS functions such as zoom, pan, identify, and queries (Duran, 2003).

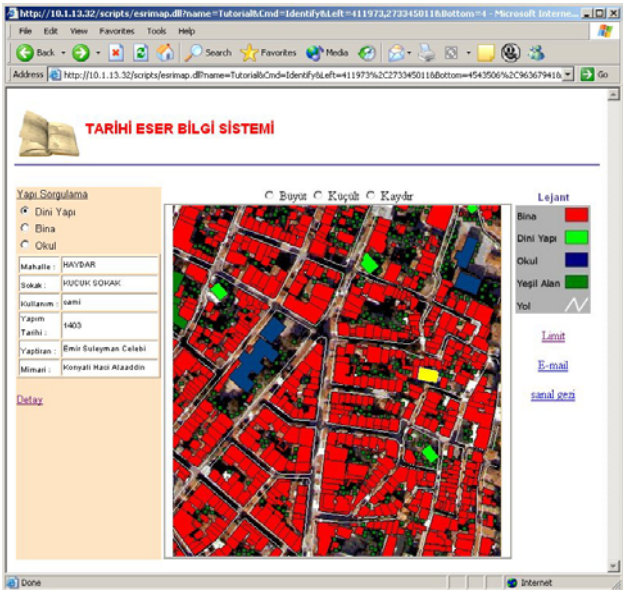

Figure 5: Web-based GIS application for visualizing data and functions for retrieving information from database.

In **Figure 6**, multimedia application based on Web is displayed. It has multimedia tools such as textual information, hyperlinks, images, video, and virtual reality.

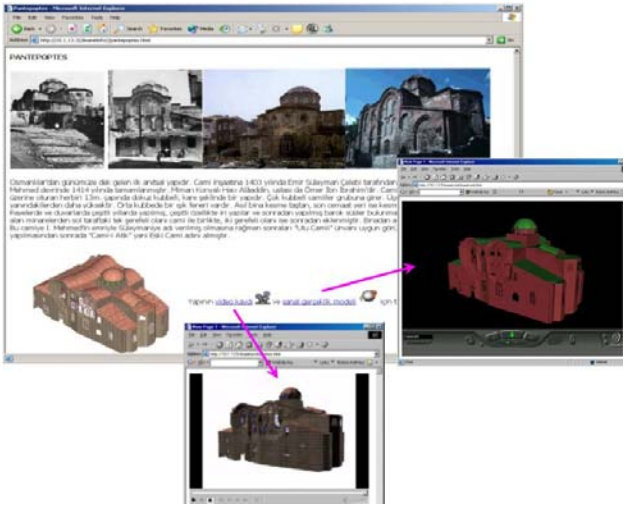

Figure 6: Web-based multimedia application provides text, hyperlinks, and images for exploring multimedia information.

3. CONCLUSIONS

An Architectural Information System with the modules and special archives provides the possibility for the comprehensive documentation of architectural cultural heritage. The pictures can be used for the documentation of pending and actual damages on buildings and sculptures. The information system will help the public to form a view on the development process of their urban environment. The awareness for the importance of the cultural heritage will be raised.

3D city models as components of geographic information systems provide for the integration of the vast and heterogeneous data required in energy use patterns, social

statistics and utilities. This kind of information can be very helpful for city administration.

The study includes many types of data and algorithms from the field of computer vision, computer graphics, photogrammetry, networking and databases. In the study, several software tools were used for processing input data, storing them in a database and presenting on the web.

Information is available for several different types of user and purposes. The system links scientists, policy makers and specific interest groups. Internet GIS with various multimedia opens up the world of GIS to a much wider set of participants. Furthermore, 2D maps cannot present multidimensional and dynamic spatial phenomena. Merging GIS and multimedia is a way to do this.

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