

VRML-based System for a Three-Dimensional Virtual Museum on the Web

J.F. Díez Higuera, F.J. Díaz Pernas, J. Gómez García-Bermejo & R. Mompo Gomez

University of Valladolid, Spain

Campus Miguel Delibes • Camino del Cementerio, s/n • 47.011 - Valladolid • SPAIN

josdie@tel.uva.es

Abstract

This work is part of a research project dealing with the design and implementation of a Virtual and Interactive Museum in 3D on the Web. The main idea for the design of this platform is to have a Web server maintained by the museum. In order to carry out our task, the global system consists of two main blocks: the user interface, and the client-server application that is in charge of the access to the server. This server contains the information that is being requested by the user. The present article is focused on the description of the first block, the user interface, that presents the information to the user.

Keywords: VRML, 3D display, Multimedia, Cultural Heritage

1. Introduction

In the last few years, and as a result of the increasing growth of the Internet, general-purpose clients have achieved a high level of popularity for static consultation of text and pictures. This is the case of World Wide Web (i.e., the Web browsers). Using a hypertext system, Web users can select and read in their computers information from all around the world, with no other requirement than an Internet connection and a navigation program. Generally speaking, the information available in Internet has been, and still is, series of written texts and 2D pictures (i.e., static information). This sort of information suits many publications, but it is still highly unsatisfactory for others, like those related to objects of art, where real volume, and interactivity with the user, are of great importance. Here, the possibility of including 3D information in Web pages makes real sense.

As we become an increasingly visual society, a way to maintain patrimony is to adapt museums to new times. The possibility of not only visiting and knowing the museums nearby but also enabling anybody to visit the building from their homes could be enabled. This would imply the incorporation of the virtual reality [4], although today few museums allow this kind of visit via Internet. This paper deals with the design of a system which allows this interactive Web access to works of art in 3D, as a step in a research project dealing with the design and implementation of a virtual and interactive museum in 3D on the Web. Users may walk through a three-dimensional (3D) representation of the whole Museum, viewing its collections, and seeing objects in 3D together with information about them. To allow all this, an architecture of interactive dynamic Web pages has

been designed, using a client-server platform which delivers the information required by the user, both 3D data of the objects and texts and 2D information. All this information is stored in a database to enable easier access and management. The global system consists of two main blocks: the user interface, and the client-server application that is in charge of the access to the server. This server contains the information that is being requested by the user. The present article is focused on the description of the first block, the user interface, that presents the information to the user.

On the other hand, recent advances are becoming popular 3D (plus color) scanners, which allow the measurement of 3D artifacts such as art works. After measuring, a 3D plus color model from the real object can be obtained. Unfortunately, a detailed 3D (plus color) model of a free form object usually requires a great amount of data. This data can hardly pass through the Web, even when using compression. Therefore, additional reduction of transmission requirements is desirable.

The Museum of Valladolid will be presented as implementation of the proposed system. It will be possible to make a virtual visit without more requirements than having installed a VRML (*Virtual Reality Modeling Language*) browser. We will describe the worlds we have created and how the user can interact with them in order to pass from a world to another and can also how to get information on each 3D artifact. Next, after a brief description of each world, some frames will be presented from a simulation that will allow us to see some of the possibilities that these virtual worlds can offer.

2. Description of the System

Figure 1 shows the general architecture of the system. It has two main parts: one is the Dynamic Web pages system, based on the IIS, which embraces the virtual visit to the 3D Museum and the access to data and its

visualization in 3D [1]. The other is the platform of telematic services, which implements the server-client architecture, allowing the transmission of three-dimensional and colorimetric data of the objects.

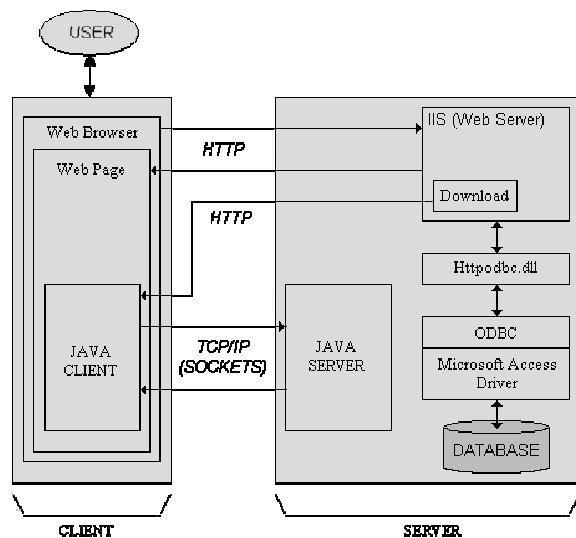


Figure 1: Global architecture of the system.

2.1. Dynamic Web Pages System

A dynamic Web pages system has been implemented to give access to the database so the information required by the user about any object can be shown. This system has also been used for a 3D virtual walk through the Museum.

Each section, or room, implemented in the Museum becomes a specific VRML file (sometimes, even a single room is divided in several VRML files). Using smart nodes from VRML language, which activate any element in a 3D universe when the user clicks on it, the file stored in the url of the VRML filecode shall be loaded, interconnect these files. Once the user is in a VRML file (containing any of the rooms where both 2D objects — pictures — and 3D ones are displayed) he/she can walk around the room at will: approach any object to have a first impression and, if wanted, click on it to acquire information about it (author, period, technique, etc.) as well as to visualize it in 3D (or with a higher resolution still image if the object is a picture). When the user clicks on any object, the dynamic Web pages system starts to work, giving access to the database and bringing the required information.

2.2. Format of the Data

VRML is the working format for the 3D display of objects, as it is a standard and commonly used in the Web. First of all, 3D plus color data must be acquired from art works. In order to accomplish with this task, we have used the Laser Acquisition System developed in the University of Valladolid [2, 3]. The corresponding object model, obtained from the acquired data, could then be directly expressed in VRML format. However, we have developed an

alternate solution which allows lower transmission requirements.

In short, we allow art works to be requested in different levels of detail (LOD). User begins with the lowest LOD model, and requests a set of progressively increasing LOD models as his interest on the object increases. We benefit from this by building the different LOD models in particular way: each LOD model is obtained from the immediately higher LOD model, by just picking some of its points. In this way, when the user ask for a higher LOD model, the whole model transmission is no more required. Instead, the new model can be reconstructed by adequately merging new points into the previously existing model. Unfortunately this strategy is not implemented in actual VRML; so we have implemented it by using a dedicated Java client. Basically, when the user ask for a superior LOD model, only additional 3D points, and a new faces description, are sent. This faces description must then be translated by the client. This is done by means of a LUT, which indicates actual position of the new points in a local VRML file.



Figure 3: Initial Web page.

3. User Interface

The user interface module is based on Web page template in which the virtual world is represented on a part of the screen, while on the rest the name of the content plus the options that the user can select are left. We have a basic system in which the user can move along the building and rooms and, already inside these rooms, the user can select a picture or a 3D artifact in order to get information about it.

Different perspectives of the Museum are shown in figures 3, 4, and 5. One of the features of the proposed system is that it allows the 3D display of an artifact in VRML format (see figure 6) which implies that the user can manipulate it as he pleases.

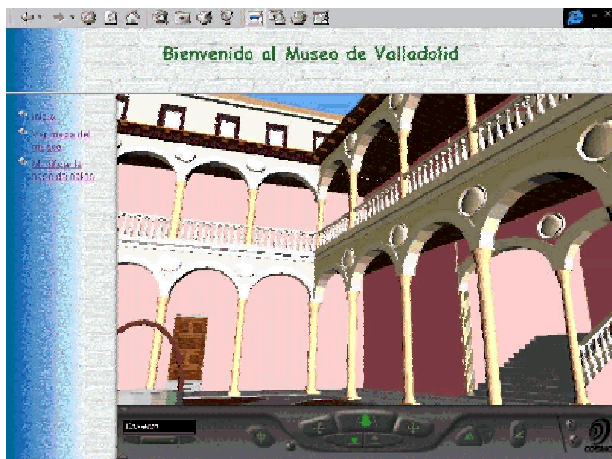


Figure 4: General view from the patio.



Figure 5: Initial view of the virtual room.

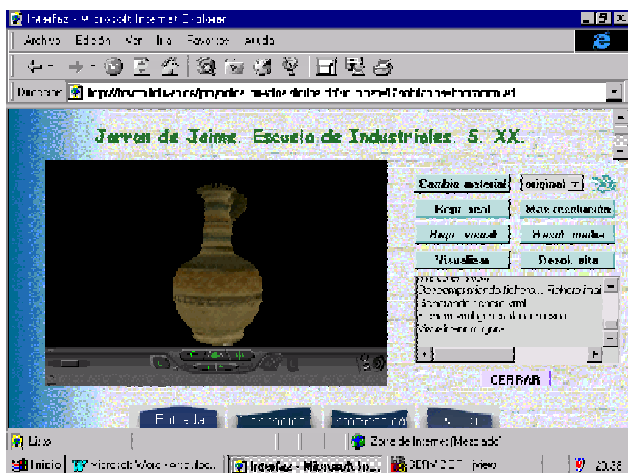


Figure 6: An example of 3D artifact.

4. Conclusions

This system means a step forward in bringing more interactivity into Web pages and, at the same time, it demonstrates the potential viability of 3D in Internet. Embracing new technologies (i.e. Java, VRML,

HTML, as well as IIS by Microsoft) has resulted in fulfilling most users aims, in the pleasure of visiting a Virtual Museum where they not only can see photos, and 3D objects, and even have the opportunity to play with them.

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