

# A CAMPUS WIDE INFORMATION SYSTEM BASED ON WEB3D TECHNOLOGIES

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*Today new web technologies are playing a great role in the way of presenting data and information to the web users. With the combination of VRML (Virtual Reality Modelling Language) and JAVA a web3d information system has been implemented for the campus of faculty of civil engineering of the university of Innsbruck. The Graphical User Interface (GUI) has been used to connect all objects over the JDBC (Java database connectivity) to the database, so as users could get easily any available information about any object in the virtual world. Different close range photogrammetry techniques have played an effective role in building the 3D Model of the Campus. The final product of this research is an information system for the campus based on the theory of Client/Server system and other web technologies which allows the distribution of the campus world wide. The virtual campus is an online service based on internet technologies and students can access the Virtual campus in a real time via the internet. With the connection of the database students are able to explore any kind of information about all courses and working persons in the faculty of civil engineering.*

## 1. INTRODUCTION

Today the World Wide Web plays a very important role in the way of exchanging data and information among the web users. Our goal was to create a georeferenced 3D base information system for the University of Innsbruck that could be available online for internet users and the university web page visitors. We started with the campus of the faculty of civil engineering so as to decrease as far as possible the amount of data and to check how far the reality could be represented and to check whether navigation and access operations for web users will be easy.

The main technologies of the internet like VRML (Virtual Reality Modelling Language), Java, Database and HTML were the most useful and usable facilities to establish such an information system. Based on the general web theory of networks, the final web page of the Campus Information System could be distributed world wide. The main goal of the information system is to facilitate the management process at the university, to enable campus information world wide and to capture as far as possible the new technologies of the internet and finally to help visitors of the faculty of engineering web page to access easily any information they want about the campus through the graphical user interface.

## 2. Virtual Model Building

Building of the campus model was the first step of the work. It was more appropriate to seek very simple and low cost ways to build the model as well as to save time and the size

of the model itself. The virtual model was proposed to be in VRML2.0 format as not to be static and to use other benefits of the last generation of VRML97. VRML97 offers good possibilities of combining static scene with dynamic scene features and such way bring life into the virtual reality. (Hanuska, 97)

The wire frame of the model was built in a CAD software using old design plans of the buildings and some important dimensions were taken from field measurements either by tapes and staves or total station. Then all buildings were modeled in the CAD software and all facades were drawn in different layers. The CAD software enables the exportation of all 3D building models into a recognised exchangeable format by other visualization program.

In a visualization program all buildings facades and digital terrain model surfaces have taken a specific ID. Then using well prepared rectified realistic photos, it was able to assign material and texture photos for all surfaces in the campus.

The used visualization program enables the exportation of all objects with textures to the required VRML format. Using an old map of the campus, all different campus features are correctly located to each other on the VRML scene. Using some nodes of VRML, all buildings were inlined in the VRML scene and they are positioned correctly to each other. Fig. (1) shows the integration of different campus virtual elements without texture into the VRML browser.

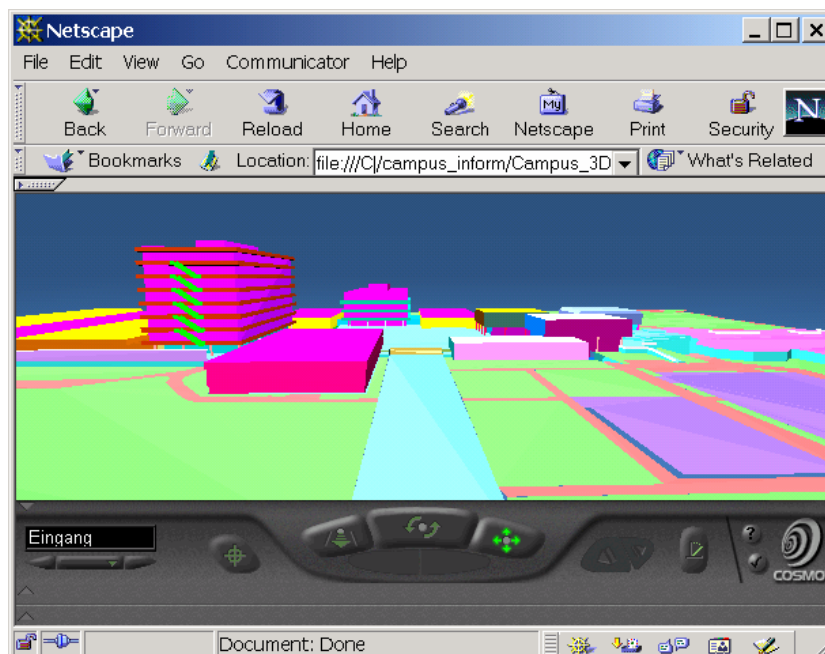


Figure 1: The model of the campus without texture in a VRML format.

### 3. Campus Information System Elements

In fig. (2) we see the system architecture elements and how they work together. The virtual world and the EAI (External Authoring Interface) are integrated together in a web

page. The integration are allowed within the recommended proposal for VRML2.0 (EAI) by Chris Marinn. The interaction between the Java external interface and the VRML world could be done through some Java classes and VRML nodes.

For Communication between a VRML world and an external environment an interface between the two is needed. This interface is called an External Authoring Interface and it defines the set of functionality of the VRML browser that the external environment can access. (Marrin, 97)



Figure 2: system components

In our information system, the EAI applet is also used to communicate with the access database of the campus. We have created an access database for the faculty which has all the information that we need to provide the users. The communication between the Java applet and the database is also done using Java technologies. The integration is done using ODBC-JDBC bridge driver which enables SQL statements to the Access database from a Java class program.

JDBC driver is acting like a traffic manager between applications and database management systems. The ODBC is a driver that works parallel with JDBC in order to enable sql access to the database. It is a great advantage to use JDBC as everything will be object oriented. The integration between the database and the program class over the JDBC will give us a big control to access the database and to establish the campus object database management system ODBMS. In the campus information system all the Geo Objects were buildings and they are represented as 3D Models in the world and they have no identifications in the database. The other objects from the Campus like institutes, persons and courses were non geo objects and they were represented like sub classes from the original buildings of the campus. All the non geo objects of the campus have taken an identification in the relational database management system RDBMS.

In addition to the fact that JDBC API gives the opportunity to open connections to a particular database, execute sql statements and process the results, it provides an easy way to handle remotely what is stored in the RDBMS.

The user interface has been designed in such a way that each action is always connected with the VRML world. The Java applet is loaded together with an initial VRML scene by the web client from the web server. Inside the web client the applet is communicating with the VRML viewer by the EAI. (Landes, 98)

#### **4. Graphical User Interface (GUI)**

As we said in the previous section, our applet is a graphical user interface as each feature even persons are connected with the VRML world. The design of the user interface has avoided the most well known deficiency in user interfaces such as slower performance, uncertainty and inconsistencies. Figure (3) is showing the final layout of the Campus Information System in the web and we can see the Java applet EAI widgets. Each widget opens a frame with different function. The user interface should make obvious how things are handled and how information is presented.

Once the user initiates an action from any of the applet buttons, information about the proposed object will be presented and at the same time we will see where this action takes place. If these goals have been achieved, we may say that the user interface is effective for information retrieval. The whole system could be considered as a web interface for the university information as we may access any data we want from the web page of the campus.

One other issue that has been taken into consideration while designing the information system is to make the navigation metaphors as simple as possible which have a great influence of understanding the information system. The metaphor of the campus has been divided into classes. We started classifying from higher class as such as buildings and then into lower classes which may be included in buildings such as institutes, computer rooms and persons.

The user interface has been designed to follow some considerations such as easy navigation into the campus metaphors and offer a spatial conceptualization for the users in accessing the campus in real time.

Appropriate user interface metaphors facilitate the understanding of the structure of an information space, which helps users to find the information they look for. This structure stems from the information domain and is communicated via the user interface (metaphor). The user interface metaphor itself imposes additional structure on the information space. (Dieberger A., Frank A., 98)

The size of the project is relatively small since we are working on a small scale as project of the faculty of civil engineering. However, the speed of browsing data from the user interface is not dependent on the VRML world because the applet itself is independent of the platform. Vice Versa navigation in the world in case that all features are fully textured

will not be as fast as accessing data from the user interface and this is much dependent on the kind of VRML viewer and the development in this area. Navigation in the world even if it is from the user interface widgets will also be slow.



Figure 3: Final Layout of the Campus Information System

The information system allows two different ways of accessing information. The first way is for the permanent users of the system and they could search or find the information that they want from the Java applet windows. The second way is for the normal web visitors and they may browse freely the virtual world of the campus and they may get any information about any feature by just clicking the feature or the signs that are representing the features. Our user interface is composed of four main windows, once the user clicks on a widget of the Java applet, it will open the respective frame of the clicked button.

The first frame is responsible about the campus touring and visualisation of the main views of the campus. The user is free at any time to stop the inner or the outer tour and to see something else and then continue touring. Actually because the features have been textured with a realistic rectified photos, the VRML world is to some extent of a big size that means the tour will go on slowly. For browsing the information system, a computer with a very fast processor will be needed. The second frame enables browsing all HTML web pages of the important objects and features of the campus. These objects are institutes, persons, courses and so on. Once the user chooses a building and an institute from this building, the web page of the institute will be opened and at the same time the user will know where this institute in the virtual world is. The same frame offers another possibility to search objects in the web page of the university. This frame has been designed using the advantage that java allows reading text files through the `DataInputStream` class. The hierarchy of the frame is also based on the simple city

information metaphors given by Dieberger, A., and Frank, A., in 1998. Figure (4) shows the campus browser frame.

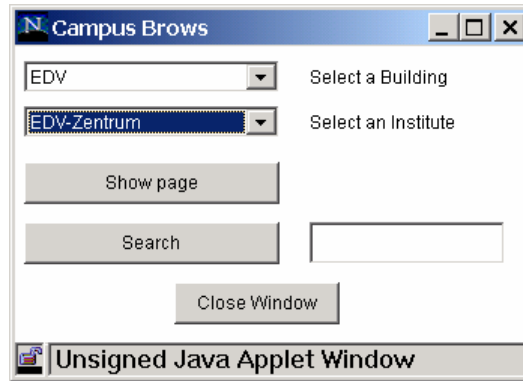


Figure 4: Campus browser frame.

The third frame enables accessing the database of the campus. It also enables searching special information about courses and staff of the whole faculty. Figure (5) shows the database access frame and the text area where the information will be presented. The fourth frame shows important two dimensions information such as the map of the campus and where it is located in Innsbruck and where Innsbruck is in Austria.

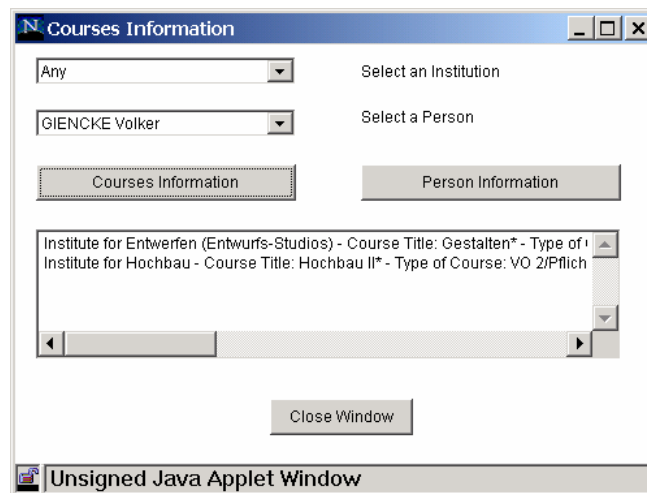


Figure 5: Database access from a Java EAI applet.

## 5. CONCLUSIONS

With the development of such information system, it will be possible to distribute the university world wide. Users will be able to access 3D Model of the campus in a real time. Representation of such projects with a real texture photos will slow effectively the process of accessing information and navigation of the campus, but it will give more realism for the users. Users will save time of searching information in different web sites as they can get the information through the user interface and they will have better imagination of what they are browsing in the campus features.

The future of the internet is promising and this example could be applied for other projects of larger scales or to other urban areas of interest to the public use. Due to rapid change in web browsers, working with internet technologies like JAVA, VRML and databases in order to develop web applications is always under development. For establishing web applications with VRML, we have to always think about the limitation of the data size that VRML viewers such as Cosmo player can browse.

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