i-architecture: the Virtual Campus

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There are a great number of current web accessible city models, that take a variety of approaches to representing the 2D, 3D and associated graphical information that they embody. The work described here represents a stage in the development of an urban modeling approach that we intend will lead to cost effective and computationally efficient systems for such systems. Our aim is to contribute to the range of approaches being adopted by different research and development groups, across the world, and particularly within Europe.

Keywords: *Internet; city models, collaborative, shared.*

Introduction

The paper reports on a particular application of a VR project which is now in its third phase. In the first phase a low-cost, but effective virtual environment system was developed. The software used was computationally efficient, being based on a games engine that optimized render quality and animation speed. The physical interface was direct and effective; we used a device that we believed was more familiar and hence more appropriate to navigating through urban environments – the bicycle (Knight and Brown,1999 & 2001a; Darken et. al. 1998).

The initial system has been demonstrated and reviewed. Following that review a second stage of development has taken place (Knight and Brown, 2001a). The second stage brought together three strands of refinement. It introduced, new ideas on low-cost, natural and appropriate interaction devices. And it further addressed the use of techniques to optimize graphical and animation performance whilst using low cost hardware, by, again borrowing techniques from games technology. In addition ideas that have arisen from parallel work in the research group on the nature and differences in perception of architectural images in a computer-mediated environment are being drawn in (Nahab and Brown, 1999).

Application: the Virtual Campus

The work described in this paper deals with the application of the system to a particular area of interest, that of the Virtual University Campus. The authors have been involved in a project to set up an effective web-based, multi-user environment for architecture (Brown et. al. 2001) for remote, synchronous access. This would allow virtual meetings, lectures, model stores, libraries and so on. The systems tested previously have been proprietry ones, such as Active Worlds: Eduverse, Blaxuun, and Holodesk. The current work takes a more fundamental approach, and is aimed at developing a customized web-accessible environment using games engine technologies.

Figure 1. The Virtual Liverpool University Campus

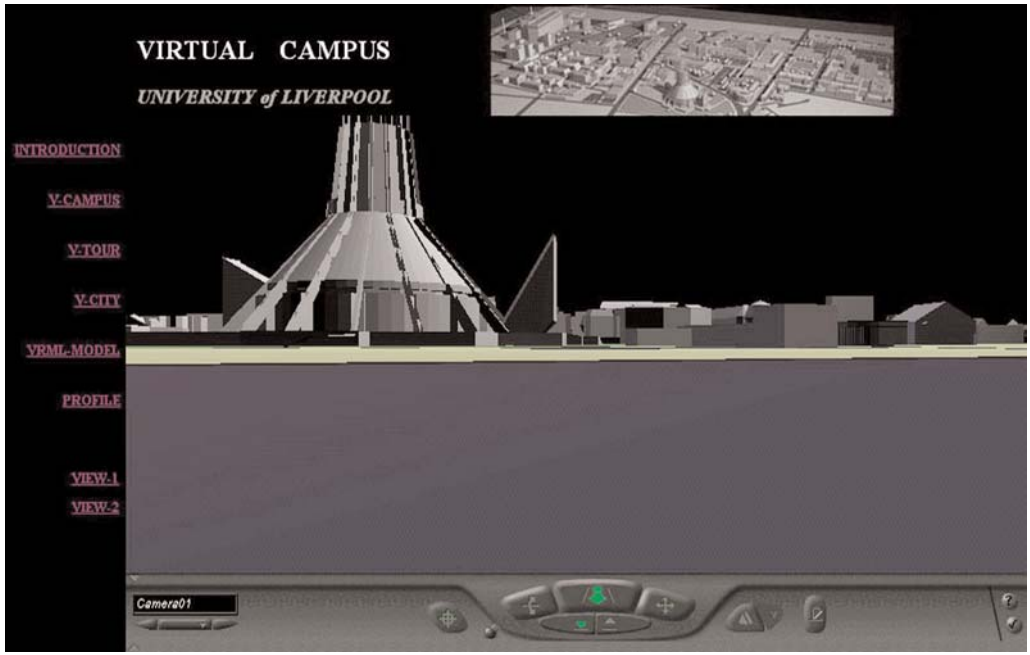

Figure 2 The Liverpool Campus model.

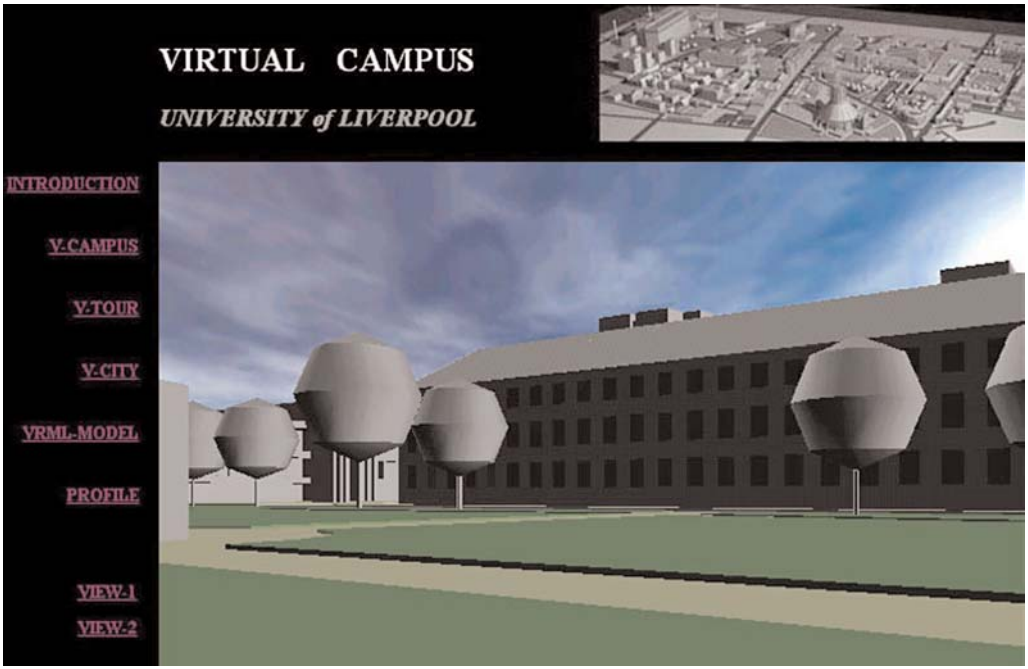

Figure 3 The Liverpool Campus model: imported to a VRML environment

There are some interesting precedents in the area of virtual campuses. For instance, in 1998 a virtual campus was constructed in Hongkong University (http://hkugis.hku.hk/campus/: June 2002). It solved the problem of constructing a quick and effective route to a search destination. In this example, the virtual campus is accessible over the Internet and it presented users with a 3D virtual environment based on the graphic data format offered by VRML. The Virtual Campus is created to provide users with interactive interface to the models linked to resources related to various aspects of the university.

In general terms there are also city information systems that allow interaction and navigation via a 3D model, that in turn interfaces to a structured database of information. For instance Peng (2001) and Peng et. al. (2002) set out an interesting way of structuring and accessing information for the city of Sheffield.

In the development of such sites, with a 3D representation of a real world analogy, the limitation is that we sometimes neglect the social characteristic of cyberspace. As a key aim of this research we aim to investigate and explore the planning and design of public cyberspace, then summarize the assessment of virtual campus environments, with particular reference to architecture. Architects and planners need to consider web environments as a social space to be designed. It is an occasion to support and foster social integration and development. Some key issues relating to the design of the virtual environment are outlined below.

In the virtual campus, and in architectural virtual environments particularly, we are concerned with improving navigation, delivery of information and effective response of such virtual environments, in which navigation plays a key role. We note that navigation is confused with locomotion but, as Darken et. al. (1998) say: 'Navigation must be seen as a process. We often make the mistake of seeing it as its end result – locomotion- navigation's most visible attribute. However, the cognitive subtasks that drive locomotion…are an integral part of the overall task'.

Clearly we must also consider appropriate representation; and in the case of virtual environments for architecture there is a legacy of visual representation in the real world that we need to examine and take account of in designing new virtual environments. Maher et. al. (2000) make the draw this to our attention: 'Although architectural design is noted for the forms and places created, the semantics of these places lies also in their function. The functional aspects of physical architecture can influence the design of virtual worlds'

It is interesting to note that contemporary thoughts on how we represent ideas and the world around us can be found to be strongly linked to, and influenced by, contemporary technological developments. For instance it is not simply a matter of coincidence that Freud's theories on dreams coincided with the birth of the technology that gave us films and cinema in the last century. That was a case of new technology inspiring creative thought and a broader understanding of an issue. This century begins with the technology and philosophy that relate to Virtual Environments in their relative infancy. The work described in this paper is aimed at developing that discussion with an appropriate example.

Some Developments

The current stage of development has the working title i-architecture. Strictly speaking this should be i^3-architecture since the core qualities are:

i Internet accessible
ii Interactive
iii Information environment for architecture.

The current implementation is being developed around the Virtools games engine. As mentioned the key reason for this is the speed and quality of interactive response that such engines produce when used to create muti-user animated, 3D world analagous environments. One further particular feature that was attractive about this engine was the possibility of direct import of 3Dmodels from conventional CAAD modelling programmes.

The CAAD Research Unit at the University of Liverpool have already developed a virtual campus tour (http://www.liv.ac.uk/virtualtour/: June 2002) that allows users to select from a set of predetermined animated 3D tours around the University of Liverpool campus (see Figure 1).

The model, shown in Figure 4, and the associated virtual environment that is being developed with this model as a core navigation tool, has been linked to the games engine representation

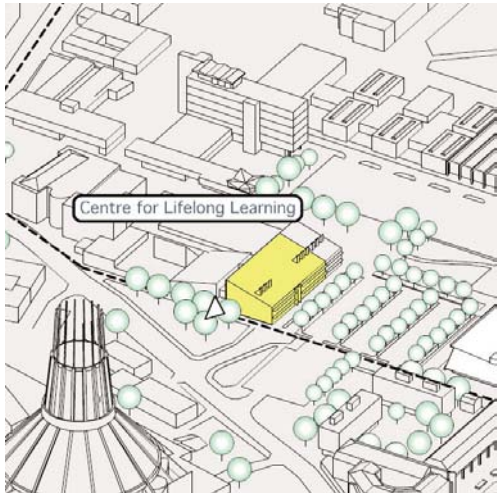

Figure 4 Liverpool campus model: Virtools environment

technique mentioned above.

Our current work involves the augmentation of the raw interactive model with experimental features that, once refined, will be tested. The features currently under test include interaction with conventional web pages, so that links from the 3D model environment take the user to a web link. Such features would be useful in a learning and teaching environment: the virtual library and the virtual lecture theatre.

A particular problem with on-line, multi-user, synchronous systems like the one envisaged (Brown et. al. 2001) is the very pragmatic one of the fact that access is barred. In a survey of over 60 eCAADe members at the Helsinki conference, two thirds of the respondents said that they had a communications firewall in place at their institution. Firewall systems often prevent access to the kind of site that we have in mind (Figure 3) so it will be important to take this into account in the development and testing of any prototype.

Future Directions

The aim of our work is to produce a computationally efficient and effective technique for multi-user, synchronous access to an urban-architectural web-based environment. We have focused on low cost systems; ones that give adequate graphic capability at reasonable download and interaction rates across an Internet connection and accessible using appropriate locomotion devices. In addition to the aims summarized above an intention has been to develop a 3D modeling technique that links to an underlying database. This has allowed us to experiment with:

- applying analytical techniques to produce visual representations of characteristics of data, such as colouring up a 3D model to show changing occupation patterns (Knight et. al 2001b).
- making the model and associated information held in a database available via a mobile, palmtop device (Berridge and Brown, 2002).

These, and parallel applications show promise and will continue to be developed.

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