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ABSTRACT

A hypermedia based UTICS (university transaction, information and communication system) is under development at the University of Auckland (New Zealand). This multi-platform system will provide alternatives to traditional forms of information retrieval and dissemination as well as public relations exercises. The UTICS will offer a virtual journey through the campus, and there are presently two techniques for incorporating a trip into a hypermedia system. The less complex "walk-through" consists of virtual walks on a given network of paths, and with the "fly-through," where movement is not restricted to given paths and places. The hypermedia system can be extended to include an expert system, which has the capacity to deal with the decision making process of prospective students. An expert system which contains declarative and procedural knowledge about the problem field can assume the role of a counsellor by assisting students in laying out their course options. Another application of a hypermedia based UTICS is the provision of information about university-sourced expertise and equipment available to the public, or groups from media, industry and government. The UTICS project will span several years and there remains a number of design problems to be solved, including image matching and the degree of detail to be incorporated in the walk- and fly-through systems. (Contains 13 references.) (AEF)

New Aspects of a Hypermedia University Representation

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Abstract: Currently, a hypermedia based UTICS (University Transaction, Information and Communication System) is under development at the University of Auckland. This multi-platform system will provide alternatives to traditional forms of information dissemination and public relations exercises. In this paper we report on various components of the UTICS. A virtual walk-through or fly-through will offer users a special way of exploring the university campus. By coupling the hypermedia system with an expert system, the UTICS will support students in their process of course selection. Finally, we show how a UTICS can assist people from outside in accessing expertise sourced at the university.

Introduction

A university transaction, information and communication system (UTICS) is an important and ambitious hypermedia system which aims to provide information about a university as a whole, communication between the various parts of a university and transaction based facilities for intra-university affairs. Universities are complex organizations because of the large number of people, the variety of organizational entities such as service providers, facilities, departments and physical entities such as rooms, buildings and general facilities which are associated by coordinated activities. Because the components of a university serve so many different purposes, a UTICS which is intended to represent the whole structure of a university in a hypermedia-based system has to contain a considerable amount of data and must offer a variety of information services.

A UTICS is supposed to help entities at the university maintain and exchange documents (letters, applications, articles) and to help in retrieval of information (e.g. finding publications, administrative documents, phone numbers or books in libraries). It should minimize and simplify the communication between individuals and groups at the university (by providing email, discussion boards, advertisements), support the instructional process (teaching, learning and training), aid in administrative tasks (scheduling courses, managing rooms), help with transactional processes (crediting and debiting of fees, automatic shipment and distribution of paper documents) and it should provide a means of communicating information to other institutions and to the public (e.g. available information should include degree prescriptions and study programmes, public events, technical resources and staff expertise for industry, government, media representatives and current or prospective students).

At the University of Auckland such a UTICS is under development. The entire system will be implemented with the networked hypermedia system Hyper-G (Kappe, Maurer & Sherbakov, 1993). Parts of the system will also be available in a single computer version distributed on a portable harddisk or CD-ROM/CD-I disks. The latter version will be restricted in that it will contain only those components of the system that serve public relation functions.

In this article we focus on two specific domains of future UTICS applications at the University of Auckland. The first part of this paper deals with a walk- or fly-through of the university campus. We discuss several questions regarding this virtual tour.

In the second part we deal with how university based information can be disseminated to reach specific groups of users. We propose a consultation component in the UTICS based on an expert system that offers information and advice about educational programmes at the university. Finally, we describe how the UTICS will assist public media, government or industry representatives in accessing expertise and equipment at the university.

Walk-through and Fly-through

Introductory remarks

For parties interested in the university, a trip through the university campus is a good introduction. The UTICS of the University of Auckland will offer a virtual journey through the campus. At the moment, there are two techniques for incorporating a trip into a hypermedia system.

The less complex one is the "walk-through", which consists of virtual walks on a given network of paths through the university campus. Attached to every path or place is some multimedia item like a picture or a video clip, taken from the real world, that is displayed as the user reaches each new section of the trip.

The more complex technique is a "fly-through" (Pimentel & Teixeira, 1993) (Earnshaw, Gigante & Jones, 1993). Here, movement is not restricted to given paths and places. A fly-through is based on a 3D model, e.g., derived from a CAD system model.

With both kinds of virtual trip through an environment a number of problems related to navigation and orientation have to be dealt with. These are determined by the technical restrictions of current computer hardware as well as by conditions of human perception and power of imagination.

Current computer graphics hardware typically includes a high-performance graphics rendering unit, a high-resolution colour display, a keyboard and some pointing and dragging device. In most cases the pointing and dragging device is still a mouse, although other devices like joysticks, spaceballs or data gloves offer more degrees of freedom and better control.

Moving and viewing inside a virtual world is an unusual environment for a person's normal senses of navigation and orientation. The situation in front of a computer screen is very poor in information diversity, compared to the real world where humans have a rich variety of senses to help them navigate and orientate themselves within their environment. In the virtual world, quite complex movements may be necessary or desirable; a user's only way to follow a course is through a window that allows a view into the virtual world.

It is therefore a complex and demanding task to design navigation and orientation support tools for a user-interface which does not require any kind of training before actual use (Shneiderman, 1992).

Comprehension of the current position and direction of movement in the virtual world as well as the current viewing direction must be as simple as possible and the screen layout must not be overcrowded with information. The support information should be as far as possible in the "background". For instance, a mouse click to pop up orientation information or a glimpse to the corner of the screen should be sufficient to find one's bearing.

The only way to satisfy these requirements is to match technical and human resources. A clever combination and exploitation of existing visual presentation tools with which users are already acquainted (e.g. maps, arrows and compasses) can provide the means for a solution to this problem.

Walk-through

In a walk-through, the user travels a predefined network of virtual paths. When arriving at a branch in the virtual path network, the user can choose which way to go next. The user can also return to a place already visited and follow another path if they choose. Depending on the multimedia items that are linked to certain stages of a walk, various actions can be taken. In the case of a picture a user could look at some part more thoroughly by zooming in. A video clip could, for example, be watched at greater speed or even backwards.

Even though a walk-through is restricted to a predefined network of trails the user can easily become confused by the continuous presentation of images and video clips. A sequence like ⟨ video clip of a path — selection of a path which continues in a perpendicular direction → video clip of the chosen path ⟩ may look as if the two paths go in the same direction as the usual perception of a rotational motion is lacking. If users do not get any additional information about the layout of the path network, i.e., if there is no overall orientation information provided, they will lose their bearing.

A possible solution for this problem is to provide a map that shows the user's current position in the network (cf. Figure 1). However, only indicating the current position and movement direction is not enough. In addition to this, the map should show the track the user has followed. It would also be useful to show the relative scale between paths already followed and the length of the paths as a whole.

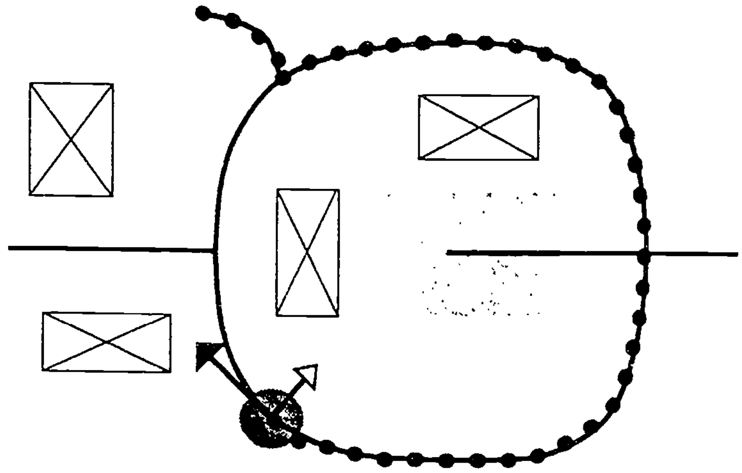

Figure 1. Network trails in a walk-through including marked motion trace, position of user, direction of movement and direction of viewing

Such a map is an additional tool that supports users in the walk-through; it may not take much space on the screen. As with large images that cannot be fully displayed on one computer screen, the presentation system must offer a way to move a window over a map and to zoom in and out so that every part of the map can be seen.

Of course, the panning speed of the window across the map needs to be adjusted to the current level of zoom. The more the user has zoomed in the slower the panning motion has to be and vice versa.

Similar aspects have to be taken into account with panoramic images which constitute a new type of 2D image in multimedia. Whereas still images are bounded in both dimensions, panoramic images are not bounded in the horizontal dimension. They depict a 360° view from a single viewing location by rotating the viewing direction.

There are two different ways to assemble the pictorial material for this type of image. One is to take a series of photographs in different directions. The other is to take a video camera and record the views while rotating the camera around a vertical axis. In both cases, the result is a series of pictures that can be joined to form a 360° view.

Previously, such a large amount of pictorial material could only be displayed by a videodisc which can store and quickly present possible viewing directions. For the UTICS of the University of Auckland, panoramic images will be created by "gluing" pictures of different angles into one 360° image (Hill, 1990) (Foley & van Damm. 1990) (Dix, Finlay, Abowd & Beale, 1993). In order to get a better ratio between the vertical and horizontal extent of the image, images will be taken in the same horizontal direction but with different vertical angles. These will be glued above each other, forming multitrack circular bands.

Displaying panoramas in a walk-through should use the same scene controls for panning and zooming that are offered for bounded maps or images. Because of the circularity of the panoramic image an indication of the current viewing angle needs to be present.

Other problems arise with the use of video clips. Motion of pictures adds another level of complexity. Video clips are mapped onto the screen by successive display of single still images. When succeeding images vary slightly from each other the impression of motion arises.

Playing a video clip at a faster speed (a common option in walk-through presentation systems) may cause strange effects. With currently available computer graphics hardware, accelerating the speed of a video clip is achieved by increasing the frame rate, i.e., by omitting a certain ratio of frames from the video clip.

These omissions can make the motions of objects in the scene look odd or even bewildering. A tree with branches swaying in the wind could appear to be trembling or moving in a clipped manner. Increasing the frame rate to make the movement appear faster works fine with global variations between frames but the quality of the presentation is poor if minor motions exist in the scene, like the waving of tree branches.

One solution to this problem would be to cut the respective object out of the image and overlay it as a sprite which is played with a lower frame rate. However, further problems like transitions at the border between the main image and the sprite may occur or other effects of different speeds in the picture may arise.

Fly-through

In contrast to a walk-through with a predefined network of paths and a fixed set of available images and video clips, the virtual world in a fly-through is based on a world modelled in 3D. The user plays the role of a viewer who is able to move freely in the modelled world and to look in any direction and at any detail. In the case of a virtual university campus, this means that the user can visit every building on campus, enter and leave it as often as desired. Understandably, the challenge of free motion and viewing conditions raises navigational and orientational problems for the user in the model.

One exemplary problem concerning orientation is the following: the user has moved close to a wall or even into a wall and the rendering system displays an unstructured or dark area that represents the user's current view. The usual first-aid measures, like turning or zooming, hardly offer any good orientational help.

In the following, we propose a collection of tools that provide the voyager in a fly-through with sufficient orientational and navigational help. The collection of help tools consists of four windows, arranged in a three level hierarchy.

The single topmost window offers the most often used information and interactive tools to the user. The user has the opportunity to modify the speed of movement and to proceed with one or several more steps in the current direction. From this window the two windows on the second level can be called to get more detailed orientational help.

The first of these displays an aerial view of the current scenery which includes the position of the user in the model and a schematic sketch of the user's current surroundings. As with the orientation map in the walk-through, a trace of the user's course in the model is shown in the sketch. The other middle level window shows a side view of the current situation. In that way, the user gets a good idea of the current vertical position in the modelled world.

Common to both windows is the sensitivity of the mouse cursor's shape to the sort of graphical item or location in the model sketch on which the mouse cursor is sitting. Every shape stands for the sort of action that can be initiated at that position. A brief textual description of the respective action is shown in a small text field within the window. The most extensive use of the mouse cursor's shape sensitivity is made inside the two schematic sketches of the model where it either means "jump to that location in the model" or "display the parameter control window".

This in turn is the lowest in the hierarchy of interaction tools. It offers a complete set of graphical interactive items which give detailed navigational and orientational information relating to the user's current position.

Here, projections of the moving and the viewing direction onto a horizontal plane are shown with compass-like items. A needle can show a viewing direction or a cone can depict the whole viewing angle, with its opening angle dependent on the extent of zooming.

Provision of information

Expert system assisted consultation

Prospective students who intend to take up a study programme at the university form one group of persons with their own information requirements. Their situation is difficult as they are confronted with a wide range of choices between degrees. In order to make the right decision they have to consider a large amount of information from several sources. There are university calendars which tell about the courses being offered, regulations for admission and enrolment procedures. Specific material informs about academic contact people in faculties and departments, about available options for financing education, about accommodation places and about career advisory services. All of this is rather overwhelming for students who have not had contact with a university before. Help is clearly needed for this decision-making process.

To overcome this difficulty we propose extending the hypermedia system to include an expert system. Expert system techniques have been used for many purposes in the last few years and they appear to be an appropriate way of dealing with the decision making.

An expert system which contains declarative and procedural knowledge about the problem field can play the role of a counsellor by assisting students to lay out their course options. The student advice situation is not unique. however. As the amount of available information in hypermedia systems grows, there will be an increasing need for such means to assist users with information retrieval.

By introducing methods of knowledge representation and automated reasoning from the area of artificial intelligence, hypermedia becomes "intelligent" (Woodhead, 1991). The raw information stored in a hypermedia system becomes knowledge that is structured and accessible in a way required by special applications and by users.

Technically speaking, the integration of an expert system into a hypermedia database means using the expert system as a subsystem of the hypermedia system. During a user's normal interaction with the hypermedia system the actions taken by the user are recorded and observed by the expert system. By collecting data about the user it develops a profile of the user. This user model in turn can be employed to influence the kind of node information and the number of links which are presented to the user in later stages of the navigational process. In that way, the user's search space in the hypermedia system can be reduced and the information available can be tailored specifically for the user's needs.

With a hypermedia system containing an expert system component, the onus of decision-making. in a dynamic context, is more with the system than with the user. This means an emphasis on context-sensitive guidance. as opposed to undirected navigation or browsing.

The main problem with the combination of a hypermedia system and an expert system is finding a way to provide the information that an expert system needs to function in a suitable knowledge representation form. In addition to this, the results of the reasoning steps performed by the system have to be usable by the hypermedia system, i.e., the presentation part of the coupled system must be able to adjust the type of information and the number of links offered to the user, according to the current parameters given by the expert system subunit.

Access to university expertise

Another application of a hypermedia-based UTICS is the provision of information about university-sourced expertise and equipment available to the public, or groups from media, industry and government. A few years ago, at the University of New York, USA, a system called ProfNet was established which put the media in touch with academic specialists. Recently, a similar system named Xpertnet has been introduced at Macquarie University, Australia (Richardson, 1993a) (Richardson. 1993b).

Both of these systems receive queries from journalists by fax or email and send them on a daily bulletin to cooperating universities. These in turn provide journalists with contact details for academics who can answer their queries or provide suitable comment. In this way. journalists can get in contact with specialists all over their country more quickly and easily.

However, the establishment of contact between a journalist and an academic still takes several hours and staff at universities are often unable to match the incoming query with areas of expertise. In this case their only way of finding a match is to contact the journalist or over-answer the query by providing every possible reply. This scenario then requires effort on the part of the journalist who must choose from the list of answers.

Moreover, ProfNet and Xpertnet are only intended for media representatives. There are other persons and groups outside the academic domain who are interested in university resources.

System like ProfNet and Xpertnet that are based on networked hypermedia systems can do better. If the information about university staff members and their areas of expertise together with information about departments and their equipment is recorded in a UTICS instead of only being available in paper form like a media contact directory or a research report, then the information can easily be kept up to date. Interested persons from outside the university can connect to the system and search inside it on their own With comprehensive information about staff and equipment users can make use of their existing knowledge in order to find a match for their query.

Conclusion

Altogether the UTICS project at the University of Auckland will span several years. The entire project will need a work force of several academics, programmers and technical staff. There will be many more components than those discussed above included in the system (Lennon & Maurer. 1993a) (Lennon & Maurer, 1993b).

There are still, however, a multitude of problems to solve. For example, panoramic images, require a reliable procedure for "gluing" single images together. At the moment algorithms provide semi-automated morphing procedures. The designer identifies several points in different images that have to be matched and the software carries out the matching for all of the points between. The next step in this direction will be more sophisticated programs which automatically find corresponding points and glue images together without human assistance.

Quite complex problems remain with walk- and fly-through systems. How detailed do orientation maps of the virtual world need to be? Or, which floor is shown in a side view schematic sketch when the user is between two floors of a virtual building? As a first approach to the virtual fly-through, the 3D scene software included in the hypermedia browsing system Harmony (Andrews, Kappe & Schipflinger, 1994) has been used to develop a small model called the "Virtual University of Auckland".

References

Andrews, K., Kappe, F., & Schipflinger, J. (1994, June). Harmony: A tool for navigating through deep hyperspace. In *Educational Multimedia and Hypermedia Annual*, Vancouver. ED-MEDIA 94. AACE Publishing.

Dix, A., Finlay, J., Abowd, G., & Beale, R. (1993). *Human Computer Interaction.* Prentice Hall, New York.

Earnshaw, R. A., Gigante, M. A., & Jones, H. (Eds.) (1993). *Virtual Reality Systems.* Academic Press. London.

Foley, J. D. & van Damm, A. (1990). *Computer Graphics: Principles and Practice.* Addison-Wesley.

Hill, F. S. (1990). *Computer Graphics.* Macmillan, New York.

Kappe, F., Maurer, H., & Sherbakov, N. (1993). Hyper-G - A Universal Hypermedia System. *Journal of Educational Multimedia and Hypermedia*, 2(1):39 – 66.

Lennon, J. & Maurer, H. (1993a, July). Lecturing technology: A future with hypermedia. Technical Report 74, University of Auckland, Auckland.

Lennon, J. & Maurer, H. (1993b, September). Applications of hypermedia in universities. Technical Report 78, University of Auckland, Auckland.

Pimentel, K. & Teixeira, K. (1993). *Virtual Reality - Through the new looking glass.* Mc Graw Hill, New York.

Richardson, J. (1993a, August). Net to catch profs for the media. *Campus Review*, 3(29).

Richardson, J. (1993b, August). Uni news network puts journalists in picture. *Campus Review*, 3(31).

Shneiderman, B. (1992). *Designing the user interface: Strategies for Effective Human-Computer Interaction.* Addison-Wesley, Reading, MA, second edition.

Woodhead, N. (1991). *Hypertext and Hypermedia - Theory and Applications.* Sigma Press, Wilmslaw.

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