VRML Virtual Worlds – An Alternative to the Desktop Metaphor for GUI's?

Mark Taylor[1], John Miles[1], Dino Bouchlaghem[2], Chimay Anumba[2], Mei Cen[1] & Huiping Shang[2]

[1]Cardiff School of Engineering, Cardiff University, UK

[2] Department of Civil & Building Engineering, Loughborough University, UK

Abstract

Metaphors are commonly used by software developers in the creation of GUI's. This paper looks at the use of multi-user VRML to create virtual metaphors, developing a conceptual design tool that can be used intuitively with little or no training.

1 INTRODUCTION

Concurrent engineering and collaborative work are becoming increasingly important to the Architecture, Engineering & Construction (AEC) industry. These methods of working allow industry to produce buildings more efficiently. Construction projects involve many different groups including architects, contractors, engineers, and clients who are inevitably geographically remote from one another. In any construction project many face to face meetings are required. Traditionally this has been achieved through collocation or through meetings[1]. This is expensive and time consuming, especially when long travel distances are involved and so IT systems are being developed to support collaborative working between remote participants. However, as these software systems mature, so does their complexity, thus requiring a complex user interface. To learn how to use such complex systems is a non-trivial task. Given the inevitable future proliferation of IT systems in design offices, it will become uneconomical for companies to use systems for which users will have to be specially trained. This is especially true for conceptual design software where software usage is likely to be infrequent. Therefore there will be a need for the development of user interfaces that will allow users to use complex software in an intuitive manner with no training. This paper looks at how a virtual reality, metaphor based user interface can provide such a user interface. INTEGRA is a software system that supports concurrent conceptual design of commercial buildings using tools such as sketching, constraint checking and risk assessment. It is the eventual goal of the project to become the user interface for the INTEGRA system.

2 METAPHORS & GUI'S

The main use of a metaphor is to explain the new in terms of the old by transferring a concept from a familiar realm to an unfamiliar realm. The formulation of metaphors usually precedes the development of clear concepts. When people encounter something new which they want to learn about, they will automatically try to fit it into their existing knowledge structure, [2]. For example when faced with a new word processing package, a user would attempt to use their knowledge of a similar program and compare them. If this knowledge doesn't exist then the user relates the word processor to a typewriter. Therefore the use of metaphors facilitates learning and comprehension.

Metaphoric terms are especially useful in the world of information technology where there are few literal equivalents. New concepts require new terminology and it has become common

practice to use metaphors rather than coin new terms. “The metaphor’s role in the global user interface (GUI) is to facilitate learning, orientation and the forming and maintaining of the concept about the program i.e. the mental model” [3].

Perhaps the most well known GUI metaphor is the desktop metaphor used by Microsoft Windows. This is a global metaphor encompassing the whole application; but it is made up of a collection of other metaphors which perhaps wouldn’t be associated with a desktop. For this reason the desktop metaphor is considered a quagmire because reality has diverged from the metaphor. For example, the trash can is a wonderful metaphor for the delete function, however trash cans are generally not situated on top of a desk. In reality people don’t have icons on the desktop but use real items such as files and sheets of paper. The vertical aspect of the desktop also subverts the metaphor. It’s closer to a refrigerator with randomly placed different magnets. The global metaphor is an example of the “bigger is better” mentality. Due to the wide use of metaphors in information technology, people are now assuming that the more all encompassing a metaphor, the more useful it is. However, the usefulness of a global metaphor is actually governed by the overall goals of the interface itself [4].

This paper looks at the development of a metaphor based user interface for collaborative work. In this case a global metaphor allows the system to be dynamic and functional in its application. The system users can collaborate through a metaphorical three dimensional virtual office environment. This environment allows the participants to interact within a virtual space and navigate around the office, in the same way that they work together within a real office environment. This is achieved by allowing the user’s mind to map straight onto their concept of a physical workspace, thus enabling them to use the interface intuitively with no training.

Although the metaphor of an office building is an all encompassing global metaphor, it does not suffer from the problems of the desktop metaphor. Virtual reality enables the number of metaphors associated with the system to be reduced, thus decreasing the degree of abstractness of the remaining metaphors. When working in an office you would expect to use a computer or a filing cabinet. These objects within the office are more virtual representations than metaphors however they still act metaphorically because interacting with them will cause recognizable results which the user will anticipate.

3 INTEGRA

The VRML interface is the user interface of the INTEGRA system. INTEGRA is an internet-based software system that supports the concurrent conceptual design of commercial buildings, combining tools such as sketching, 3D visualisation, constraint checking, shared design spaces, project file stores, rationale capture and risk analysis etc. to create a functional conceptual design tool.

4 SYSTEM ARCHITECTURE

Figure 1 shows a simplified diagram of the system architecture. The diagram is specific to the user interface and does not include all of the INTEGRA system applications. The interface uses two servers which run simultaneously. One server uses the Microsoft Internet Information Services encoding whilst the other is a Macromedia Flash Communication Server. Two servers are required because the Flash server only handles internet communications that have been written using the Macromedia Flash language. The advantage of Flash is that the communication applications can be run using a standard Flash player. A designated server is important due to the high bandwidth required by such communications. Everything else is handled by the other server including the BSCW software. BSCW (Basic Support for Cooperative Work) is a 'shared workspace' system which supports document upload, event

notification, group management and much more. BSCW is fully accessible from a standard web browser [8].

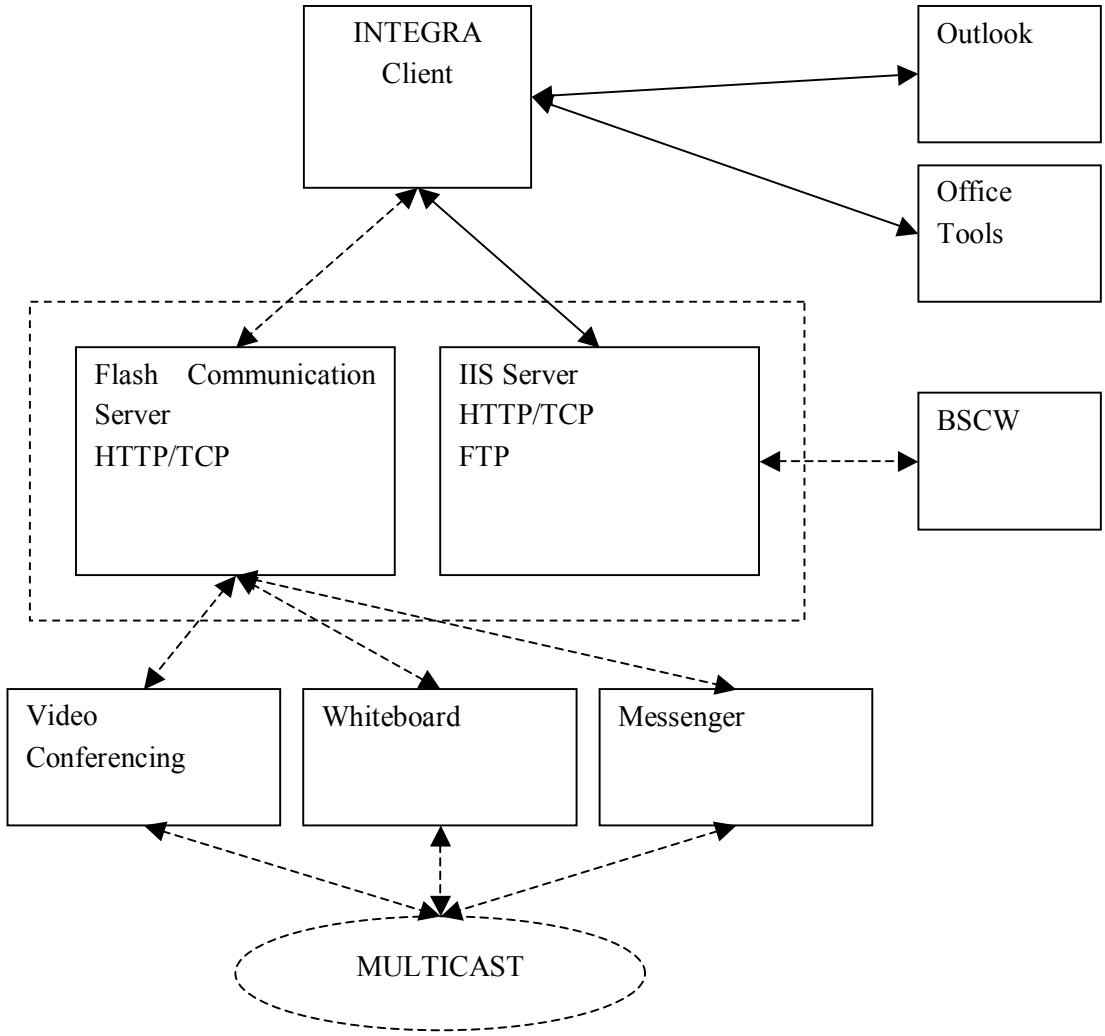

Figure 1. System Architecture

4.1 General Applications

The email and agenda application will be the standard application used by each individual user. The most common application used today is Microsoft Outlook and this is what the system has been developed to handle. Office tools are not part of the system but refer to tools that the user can use from their own computer.

Both the office tools and the email/agenda program can be run from each individual user's computer with no links to the server itself. Work is carried out using these applications and can then be transferred to the server when required.

4.2 Flash Communication Applications

Macromedia Flash is the language used to write all of the communication applications used by the INTEGRA system. Then using the Flash Communication Server allows users to utilise these applications with a simple Flash Player which is free to download over the web. Video/Audio conferencing is an important tool to collaborative work. The system will utilise two versions of this software stored on the server.

One version will be used for one to one conversations whilst the other will be specifically for multi user conferences. Both versions utilise oral/visual conversation and text chat between participants. Figure 2 shows a screen shot of the larger, multi-user video conferencing application being tested by two remote users.

The interactive whiteboard application, also written using Flash, will allow multiple users to alter drawings whilst chatting about the drawing via text or audio, useful for quick clarification of design aspects.

The final application is the messenger system. This is purely an instant message sending tool. The messenger system allows users to easily send messages to each other and will allow text chat between multiple users. The messenger application works in the same way as the increasingly popular Microsoft Messenger.

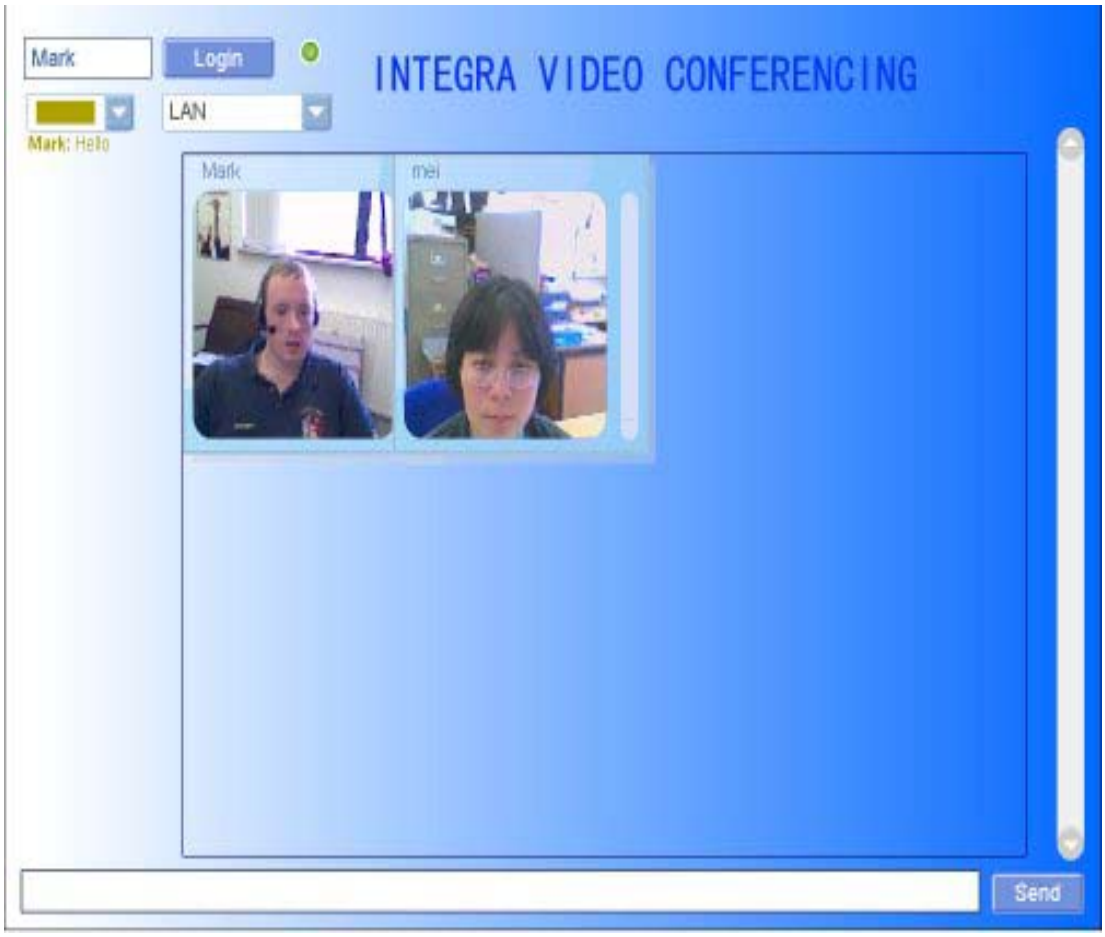

Figure 2. Multiple User Video Conferencing

5 THE VIRTUAL OFFICE

This section deals with the three dimensional virtual office building. The virtual office has been created using VRML (see section 3) with some interactions requiring the added functionality of JavaScript. The office building's role is to act as the user interface for the system and link all the applications through user interaction. The multiple users are handled by Blaxxun Community Platform 7 which uses Internet Information Services to set up a server which can send and receive data regarding the position of the avatars within the virtual world. The software gathers data from each of the users and then updates the host world. This updated world is simultaneously being sent to those users that are logged in.

5.1 Office Building

The office building has multiple floors. Each discipline is based on a different floor with access to each floor being via a lift (elevator). Each project will be represented as a new office building with all the required floors. Figure 3 shows a schematic layout of a typical floor within a virtual office building. Keeping the layout simple is in keeping with the need for a fast accessible system in which the object is not to achieve total reality but to provide sufficient information for a comprehensible user interface. Each project team member receives a private office on being registered as a system user for a given scheme. From this office most of his/her work and communication is carried out. The other areas available for exploration are the communal areas, file share rooms and conference rooms.

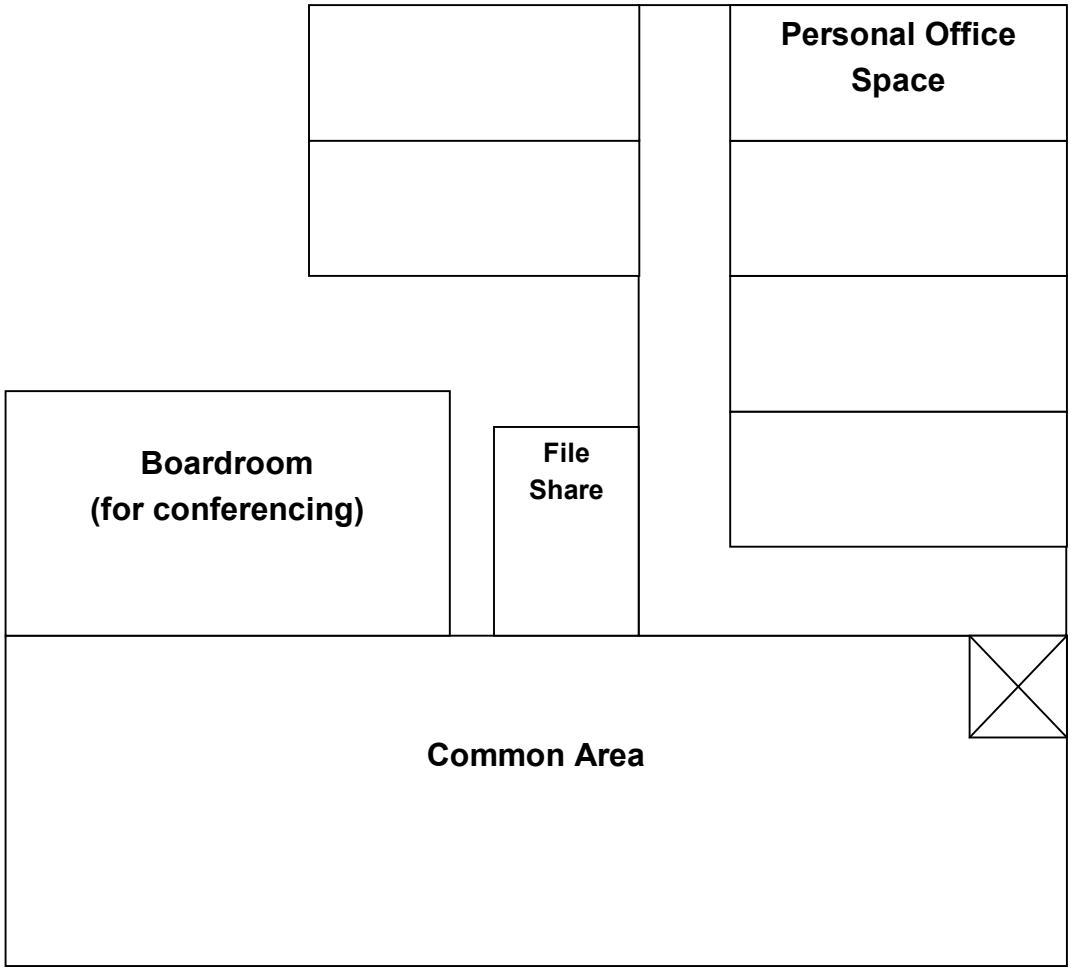

Figure 3. Plan View of Single Floor Layout

5.2 Private Office Space

The private office is where most of the work is carried out and most of the interactions occur. From his/her office the user is able to access all of the system's applications; video conferencing, file share, email, whiteboard etc. Figure 4 shows the virtual personal office space within the Global User Interface (GUI). The GUI uses a HTML frameset style with the virtual world situated in the main window and the remaining frames handling various data and information considered relevant to the user. The office contains standard office furniture and many of the objects allow interaction by the user. These objects are also metaphors that allow the users to interact with them in the same way they would within their own office at work. This is important as it keeps the system simple allowing users to use the system instinctively.

Figure 4. View of a virtual personal office

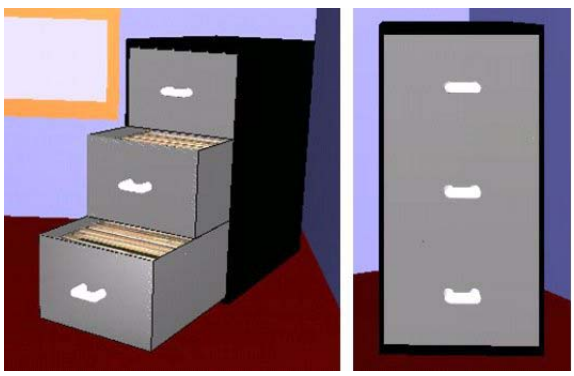

Figure 5. Virtual filing cabinet both opened and closed

Figure 5 shows the filing cabinet which is situated within the personal office of all users. This three dimensional object is the metaphorical representation of the electronic file storage used by the project management system. Opening the filing cabinet and clicking on the files will take the user to the file explorer system.

While "seated" at the desk the user can access most of the available tools. The computer gives access to email and agenda systems such as Outlook. These are activated by merely clicking on the computer. In a similar way the phone allows the sending of an instant message to any user, perhaps requesting a face to face meeting. One on one video conferencing software is also accessed via the phone.

5.3 Communal Area

The communal area is an area within each floor that acts like a common room. Any user can walk into the communal area from which he/she will be able to interact with any other user situated in the room. This will allow for general discussion and informal meetings between co-workers. This area will be helpful to the user if he/she has a small problem that they need help with but do not want to bother someone who is busy. After clicking on a co-workers avatar a one to one video conference begins.

5.4 File Share Room

The general file storage area can be found on each floor within the building. Any user with security clearance can access files placed in this room, however, the files kept in the private files store will be exclusively accessible to the room owner. The general file store room also contains a three dimensional filing cabinet although a slightly larger version. The BSCW document handling system is currently being used by the INTEGRA system for file storage and security.

5.5 Conference Room

The conference rooms contain large tables around which many users can sit. The rooms have whiteboards and the multi-user video conferencing takes place in them. Times may be posted and users just need to access the room before the conference is due to start in order to be included in the video conference.

6 SUMMARY

Using metaphor based user interfaces is not a new concept. It has become standard practise for most software developers. There are arguments for and against these types of user interfaces. Some advanced users will argue that having such an interface limits their ability to make full use of the applications. However the majority of users do not come within this bracket and for them, metaphor based user interfaces are very useful.

This paper has looked at the user interface of the INTEGRA system. It uses what is best described as a 'virtual metaphor' to create an interface which is functional yet simple, allowing the users to interact with little or no training. The system can be used intuitively with the virtual reality creating a metaphor that the users can relate to from their own previous experiences.

The metaphor based GUI is written in VRML and uses the Blaxxun Community Platform 7 to handle the multiple users. The virtual office building is the setting for the user interface and from this building the users will function as if working in a real office. The personal office is where most applications are utilised. Interacting with virtual filing cabinets starts the file management/document handling system BSCW, face to face meeting of avatars starts video conferencing etc. The communication applications have been written using Flash to enable full

functionality with a simple add on available over the web. The eventual goal of the project is for the interface to replace the existing simple HTML based user interface currently in use by the INTEGRA system. Once this is achieved an extremely unique collaborative working environment will have been created!

7 REFERENCES

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