ePAD: A Portable Aided Design Tool for Remote Collaboration

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BACKGROUND

"ePAD" represents phase II of a research study conducted as part of a Master degree thesis at the School of Architecture at UBC titled "Inhabiting the Information Space: Paradigms of Collaborative Design Environments," which resulted in the introduction of five different applications: the pinUpBoard, the sketchBoard, the mediaBase, the talkSpace, and the teamCalendar. All of the above applications were developed to serve as a design collaboration medium for architects to share and exchange knowledge from remote locations in real-time.

The ePAD is an extension model for these applications. Each of these applications has served a specific functionality within the tools it offered.

The paper will showcase phase I of this research in some detail, taking each application and describe its different functions and tools while at the end of phase I, an evaluation of the tests that were conducted on them will be given.

PHASE I

The main focus of this research is to explore the potential of collaboration technologies in the field of architecture, develop applications that facilitates communication between designers, or students and tutors in remote locations. Additional objective is to understand the emerging needs associated with the new medium, to enhance the effectiveness of the design process and increase the efficiency of communication with the simple Web-based tools. Five different part of prototype applications were developed and tested.

pinUpBoard

The pinUpBoard has offered an interface for realtime media sharing, discussing and browsing on the net, allows collaborators exchange ideas, critique work simulating by that the gathering around the pin-up board by the design team and others. Several features were integrated with this application. The user can selectively present the media in a non-linear fashion instead of a slide show as well as a memory management for the images that are preloaded into the cache memory of the end users' computers to allow for maximum speed of interaction and collaborative browsing. The technology being used is based on Multiuser Shockwave Server by Macromedia Inc. The Multiuser server is responsible for handling all the connections and the transfer of data among collaborators. It has its own database of users to handle the access control.

sketchBoard

The same server is used for the sketchBoard , which is an application that provides a number of virtual board rooms with an internet-enabled whiteboards to allow for realtime sketching by collaborators on the same board. A set of drawing tools is provided with the ability to select the shape, size, color, and direction for the brush.

talkSpace

The talkSpace is a chat program with multiple subject discussion forums, customized to be used by designers. It offers the collaborators to selectively send the text messages to the participants as they exchange the conversation. The talkSpace is also controlled by a database of registered users for security. This program is based on CGI scripts that run on Apache Web server.

mediaBase

The mediaBase is a Web database management system that allows collaborators who has been given password verified access to manipulate a specific database file on the Web by adding, modifying, and deleting records. This application can help the design team members to control a central media database for a project, or a client and accessed from anywhere at any given time. The mediaBase is based on CGI scripts that run on Apache server as well.

teamCalendar

This is a Web-based group calendar that allows collaborators to add, modify, and delete entries from a shared calendar. While the team members can all view all of the scheduled events, only the publisher of a message can modify it.

The Collaborative Scenario

All of the above applications were tested with the number of architectural students based on a preset scenario for design collaboration as follows:

Step1: Meeting on the Internet using the talkSpace application to set the project type and discuss the work methodologies.

Step 2: Scheduling the next meetings and deadlines on the teamCalendar application and checking with each others' availability schedule to organize their work.

Step 3: Starting a sketchBoard session on shared screens, where they discussed the initial project details by sketching over and commenting on it.

Step 4: At the end of the sketchBoard session, the data is taken and compiled as a vector drawing on a CAD program. Also they rendered some images to prepare for the Web presentation.

Step 5: Uploading the prepared media to the mediaBase to make it available as records in a structured database on the net.

Step 6: At the scheduled meeting time for the pinUpBoard session, collaborators logged in as they were able to demonstrate the work and share the screens in realtime, taking turns in controlling the browsing session. The team was able to exchange comments, red circle areas of drawings, measuring, zooming, and panning the media on the screen.

Step 7: As the first pinUpBoard meeting is finished, many subsequent sessions were followed for design feedback, until they reached the desired results.

EVALUATION OF PHASE I

Taking into consideration the project size, and how it can be elaborated to provide what is expected from it, is the main factor that has led to phase II of the project. One of the issues of concern was the monolithic structure of each application to serve a certain function, disintegrated from each other. The first conclusion was that a set of tools does not necessarily create a medium. Characterized by the metaphor of the information space as medium of communication for designers to supplement the physical studio space, the application lacked the flexibility required to accommodate new functions. Extensibility of its components is essential for such multi-sensory communication. Designers work is based on creativity and to allow for unforeseen actions, we needed to implement another prototype that is totally object oriented in structure that will allow the integration of those tools to act as one open interface that hosts different functional objects. The object can represent a set of routines to implement a certain function, or may be a media object with interactive features, or even an animation file.

Drag and drop feature is a favorite method for most designers to interact with objects on the screen. This feature needed to be implemented for phase II. Taking the drawing to an outside CAD program is a bit cumbersome since at this level of communication (The primary stage of design) the drawing can be presented as outlines and abstract forms. The decision was to create a basic portable application for vector-based graphics, to allow for the creation of a drawing on the net and on real time.

PHASE II

Based on the applications discussed earlier in phase I, a new outline for the prototype is drawn below, bearing in mind the problem associated with the close architecture of the programs.

1. Open Interface: The ePAD should be capable of hosting custom objects for media interaction.
2. Portability: The flexibility to be hosted by a Web browser or as a standalone application on the operating system with minimum loss of functions.
3. Extensibility: Extensive use of Macromedia's Flash technology, a vector based application that is capable of handling a high level of interactivity with minimum network bandwidth, as well as the ability to communicate with other Web applications and servers.
4. Lightweight: An intuitive interface with the ability to dynamically load and unload objects which will result in a small seed file on the end user's machine.

EPAD ARCHITECTURE

The main open interface of the ePAD is less than 100K. Each design and communication object remains externally linked to a database until it is called by the ePAD. The size of each basic object remains under 100K. Bitmap graphics or animation files are loaded dynamically into the object and the size of it will be depend accordingly. Each basic object is designed and built completely in Flash 4. That means objects will display flawlessly across numerous platforms including Macintosh, Windows, Solaris, Linux, and additional Web-appliance platforms. Additionally, Flash Player source licensing (free) ensures that any future browser, platform, and Web-enabled device (i.e. PalmPilot) can offer Flash playback capabilities. Another advantage of Flash objects is the capability of printing high quality vector drawings off the net by using the Flash 4 Printing SDK.

The Flash object consists of different layers. The bottom layers have the background graphics for the interface, while the middle layers contain the drag and drop objects. The upper layer is for the control buttons and menus. The multiple layering system allowed us to add personalization features for Flash objects. The general object properties can be customized to the personal preferences in terms of color scheme, net identity, and above all the size of the ePAD. Users can resize the ePAD main interface to any appropriate

size, which will result in resizing the embedded Flash objects as well.

Hosted by a shockwave application, the ePAD is capable of performing tasks to communicate with other ePADs through the Multiuser server. The connected ePAD user will be able to tell who is connected at the moment before logging in and decide whether he or she want to be engaged in a collaborative session. Similar to ICQ features, except the ePAD has the capability of handling different levels of communication and interactivity.

Another important feature of the ePAD is that it preserves multiple connected applications per user at the same time allowing the user to move from one pad to another to perform different tasks and go back. Each PAD object has a connection indicator that sits in the background and tells the status of the connection per object.

Currently, five PAD objects were developed and under testing:

1. "pinUpsPAD": An enhanced version of the pinUpBoard from phase I and more compact. It allows sharing and browsing media off the database server in realtime while displaying the associated information for the recorded media (title, date, creator, notes, etc.). Calling the media into the pinUpsPAD is initiated any participant who wishes to share a media item that is uploaded previously to the database server. Selecting the media item by dragging and dropping it over the live screen. Binary media transfer is also an option under examination, since it may delay the communication over low-bandwidth connections. The pinUpsPADs for connected users have synchronized content that is controlled by the Multiuser server.
2. "plannerPAD": A new PAD object that is based on a two-dimensional workspace diagram that could be a front view, a floor, or a ceiling with links to external library of architectural symbols (in vector format) that can be loaded and unloaded onto the workspace, draggle, editable geometry, shape, color, size, and pattern. This tools becomes very handy to build diagrams at the conceptual level or even more detailed one. The user can save the workspace as another record to the database and be called back again when needed.
3. "sketchPAD": A similar tool to the sketchBoard in phase I but it has only one whiteboarding session because of the extensible nature of the ePAD to duplicate in the objects realtime. The drawing tool is faster and more flexible than the previous version. The sketchPADs of the connected users are synchronized with each other and controlled by the Multiuser server.
4. "talkPAD": An enhanced version of the talkSpace. Drag and drop capable interface. The talk output object can be dragged out of the talkPAD to allow the user to run another application in its place while watching the talk session in the background.
5. "calendarPAD": A graphically enhanced version of the teamCalendar in phase I. It offers drag and drop capability between the calendar dates and the events. Authorized users can change the location of the event in the calendar by dragging it over to a different one instead of accessing the specific date separately and editing it.

CONCLUSION

Features of a traditional paper-based note pad were exploited in terms of its portability, accessibility, lightweightness and ease of use. The ePAD preserved the casual and sudden approach of using it, while extending its functionality to provide additional tools for basic design and communication.

The ePAD objects are yet to be tested among other groups of people. Possible Profiles of usage are:

1. At the personal level, the ePAD; because of its portable nature; can act as a sketch pad to be used by the individual to record ideas and sketches to be accessed from anywhere at any time.
2. A tool for consultation between the design team members where they can have their ideas examined by colleagues, exchanging ideas and critique of the work from remote locations.
3. In the academic field, students can help each other solving design problems at the conceptual level and getting advice and consultation from their professors. Also it can be used as an evaluation tool for design jury members distributed over different geographical locations.
4. The ePAD is capable of producing high quality print outs off the net. Printing as vector graphics eliminates the pixilated effects resulting from printing low-resolution bitmap graphics at high resolutions and allows ePAD media objects to be scaled and printed at any size.

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