DEVELOPING DESIGN ARCHIVE AND VISUAL NAVIGATION INTERFACE FOR DIGITAL ENVIRONMENT

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Abstract. The digital media is most convenient technologies to realize collaborative design environment on the world wide network. A lot of practical Virtual Design Studio projects have been already executed in the world and lots of researchers try to develop more efficient web-based design systems for Virtual Design Studio. On these systems, the digital bulletin board is generally used to support for group discussion and exchanging design proposals via the network. But it is only possible to store and refer design proposals on the web. Its interface and operation are not well-optimized for architectural design activities. Then we consider that it’s necessary to develop the design information archive and visual interface to support digital design activities. The APEX and VPB system is the integrated design environment and we report the results of our experimental design studio using with it.

1. Introduction

In general, an architectural designer will create a lot of design materials to consider his design ideas. The proposed ideas are exchanged with the other participants of the design team and examined by teamwork. In the digital design environment, it is difficult to accomplish efficient group work on the web. There are several reasons. First, the designers have to manage a lot of digital materials and design information. It’s contained of memos, text documents, sketches, orthographic drawings, physical models and CAD/CG data files and so on. The amount of them is increased step by step in design
project. These materials are stored as individual digital files as design record. It is difficult to identify the relationships these fragmented design materials. Second, the computerized design procedures are too complicated to understand the flow of concurrent design activities. A lot of design proposals are updated and exchanged simultaneously in the team via the network. The designer has to find out the current and important proposal from the amount of stored materials. Third, the interface of web-based design environment is generally constructed with static HTML technologies. It is not suitable for interactive and visual navigation of complicated design procedure.

Now it is needed to build web-based database to manage a various design materials and navigate them with graphical and interactive method.

2. Analysis of Design Activities

In order to develop the digital design environment, we observed our experimental design projects and recorded our design procedures to define what materials and navigation method is effective for architectural design. Then we analyzed and classified them as several models.

2.1. CATEGORY OF DESIGN MATERIALS AND PROCESS

In order to construct the framework of design information archive, we tried three design projects in our students’ design studio. We recorded all design materials and exchanged proposals throughout those projects to preserve our team’s collaborative design activities. Then we described them as the visual flowchart to understand what materials and information are needed in each stage of projects. The part of flowchart is shown in figure 1.

![Figure 1. Flowchart of the process of experimental design project](image)

From this flowchart, we could understand how we imagine our design concepts and represent them to others in the projects. We found the several
types of design materials used in collaborative design projects. We classified them into seven categories;
1) Texts of primary keywords,
2) Texts and diagrams for concept making,
3) Photos and 2D graphical images,
4) Hand-drawing and sketches,
5) 2D-CAD drawings or 3D models,
6) Animation and Multimedia data,
7) Presentation Board and Final Drawings.

2.2. DESIGN ACTIVITIES WITH CONVENTIONAL PINUP BOARD

For architectural group work, a graphical pinup board is generally used to share various materials and exchange proposals within the design team. The participants are able to present their recent ideas on the board at any time. The other participants are able to refer to them to know which proposals have been recently updated and considered in their team. We think that the pinup board to be very useful to support both of synchronous and asynchronous design collaboration. And it is possible for us to understand the overview of current group activities. The major advantages of the pinup board for collaborative design are listed below.

1) The current activities of the team are displayed graphically on it.
2) It’s easy to overview the recent materials without complicated operations.
3) The materials are handled dynamically and arranged to understand the relationship of them.
4) The expired and unnecessary materials are covered naturally behind the new one.
5) It’s useful to present graphical ideas in synchronous design meeting.
6) It’s easy to add new materials and proposals asynchronously by the team member.

3. Overview of Implemented System

Therefore we have developed the system of Architectural Proposal EXchange (APEX) and Visual Pinup Board (VPB) interface to mediate digitalized design group work for our design studio environment.

3.1. HARDWARE AND SOFTWARE

The APEX and VPB system was composed with several web technologies and we programmed it with the languages of Dynamic HTML, PHP,
JavaScript and ActionScript of Macromedia Flash. On the server side, the system works on the Apache WWW server and MySQL free relational database in Mac OS X. On the client side, the system is accessible to all network members only with the standard web browser, MSIE, Netscape and Firefox.

3.2. FEATURES OF THE APEX SYSTEM

The APEX system supports three typical stages in architectural designing on the web. It is possible to record various design materials into integrated design information archive. The illustrated flowchart is shown in Figure 03. First, using the “Resource Pinup Board”, designers can save and share all private design materials as Design Resources with graphical thumbnails icons. They can refer to them at any time in order to reflect on design ideas. Second, using the “Private Pinup Board”, designers can make their own design proposals only by selecting some necessary materials registered on the APEX system. Finally, using the “Group Pinup Board”, designers can offer their own proposals to others via the Internet. A set of these design materials and proposals are registered in APEX to review the design process graphically.

3.3. FEATURES OF THE VISUAL PINUP BOARD INTERFACE

The Visual Pinup Board interface is integrated entirely to the APEX system and it’s available to manipulate dynamically proposals and materials recorded in the APEX on web browser. The major screenshots of APEX/VPB system are shown in figure 3.
Our implemented functions of Visual Pinup Board are listed below.
1) Navigation method is similar to conventional pinup board and easy to understand how to use it.
2) Resources and proposals of design project are displayed as the graphical and suggestive thumbnail icons’ layouts on the web.
3) It’s available to arrange thumbnail icons freely with simple drag & drop operation.
4) Sets of icons’ layouts are preserved as the course of design progress to evaluate design procedure after project.
5) The recorded layouts are reviewed as dynamic animation view on the web.
6) It’s available to add comments graphically as small “post-it” icons to any proposals.

4. Design Studio enhanced with the APEX/VPB System

We have already tried a couple of experimental design studios with the APEX/VPB system in our research group. In these projects, we evaluated the functions of the APEX/VPB system environment for synchronous design discussion, asynchronous group working and analysis of design procedures in these projects.
4.1. SYNCHRONOUS GROUP DISCUSSION

The APEX/VPB system could support the graphical design discussion on face to face environment. It’s easy to take out the stored proposals and digital images from the APEX database. The participants could browse and indicate the detail of them in wide projected computer screen on white board. In this environment, we could use the Visual Pinup Board for creative group discussion.

![System diagram and scene of design meeting in our digital design studio.](image)

Figure 4. System diagram and scene of design meeting in our digital design studio.

4.2. ASYNCHRONOUS GROUP WORK

In asynchronous or distributed group work environment, we could exchange design materials and discuss about them in virtual environment on the web. The designer could register his proposals to the APEX/VPB system as a set of several CG images, drawings and CAD models asynchronously. The other members and critics of the team could refer it and comment in any time. These asynchronous design progress are displayed graphically on the Visual Pinup Board. The screenshots of asynchronous discussion and list view of recorded comments are shown in figure 5.

![Registered proposals and critiques are arranged dynamically on the APEX/VPB.](image)

Figure 5. Registered proposals and critiques are arranged dynamically on the APEX/VPB.
4.3. ANALYSIS OF DESIGN ACTIVITIES WITH APEX/VPB

There are some functions to review the historical activities of design procedures in the team. It’s available to display the animation and visual chart of the amount of registered materials, classifications, timestamp and member’s name.

Figure 6. Dynamic animation review and statistical analysis of design project.

5. Results and Conclusion

In this paper, we discussed about the design database and its interactive navigation interface optimized for architectural group design. After our design experiments, we asked the participants about the design procedure in the APEX/VPB system environment. Almost of them answered that it was efficient for virtual group design on the web and the APEX/VPB made it easy to deal with amount of design materials. In the future, we will improve this system environment and apply it for more practical design project.

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References


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