

# A STUDY OF DESIGN INFORMATION SYSTEM FOR NETWORK COLLABORATION

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**Abstract.** In this paper, we discuss about the architectural design collaboration and information management based on the worldwide network. Internet and WWW are rapidly infiltrating through the architectural schools in the world, so it is easy to communicate and share the design information with web homepage and e-mail. But, a set of homepage and e-mail is not sufficient for easy and smooth design. Because of the data management method and system for network collaboration is not yet well organized nor well developed. In this paper, we report the results of two Virtual Design Studio projects that we have experienced and intend to analyze the problems to exchange and share the design information on the web. Then we propose the collaborative design system environment and evaluate it from the result of the experimental third Virtual Design Studio project that we have executed.

## 1. Introduction

Since Prof. W. J. Mitchell of MIT proposed the concept of global design collaboration via Internet as the "Virtual Design Studio" in 1993, many VDS projects have been executed throughout the world. Internet and WWW technology have been greatly improved during these five years. Now, for almost of Japanese architectural schools, it is possible to open homepage and publish their design activities on the Internet. Anyone can browse these activities and work together via the Internet. But it is not easy for collaborative design using a set of homepage and e-mail. There are several reasons not to achieve it. First, design tools and network system environment is not yet well organized. Second, the data management and sharing method on the network is not defined yet. In the network, it is needed to support the various interactions of designers and record them as unified database. The location of the users and the time of the collaboration involved as illustrated in Table 1.

*Table 1.* Matrix of Style of Computer supported Collaborative Design

	<b>Synchronous</b>	<b>Asynchronous</b>
<b>Local</b>	Face to Face Interaction Sharing Time, Space and Information (Meeting Room and Pinup Board)	Overcoming the Gap of Time Sharing Space and Information (Online Message Board and Web)
<b>Remote</b>	Overcoming the Gap of Space Sharing Time and Information (Desktop Videoconference)	Overcoming the Gap of Space and Time Sharing Information (Electric Pinup Board and Interactive Web)

## 2. Research Approach

In this study, we aim to make clear the problems of network collaboration and develop the information system environment based on the WWW technology. This paper describes the following three points to evaluate the network collaboration.

1) Design Procedure and Data Management:

What kind of design process and method is efficient for digital network communication and design education?

2) Requirement of Tools and Information System;

What kind of tool is needed for collaborative design? It is important to verify and integrate synchronous and asynchronous collaboration tools, such as the desktop-videoconference, application sharing, homepage publishing, pinup board and web based information database.

3) Spatial Design of Working Environment;

What kind of actual workspace and system is needed to support interactive design jury and education in network collaboration.

Through these analyzed points, we aim to make efforts to build web-based design system environment for networked design collaboration.

## 3. Consideration of Web Based Design Collaboration

We have experienced two VDS projects with Kumamoto University, MIT and with Tokyo Denki University, to find out the problems of collaboration style and data management on the network. So we intend to classify the problems of each VDS project, in terms of the system environment, management of distributed data and design education.

### 3.1. VIRTUAL DESIGN STUDIO'96 @ KUMAMOTO

#### 3.1.1. Overview

This VDS project was executed as student's design practice in 1996 with Kumamoto University, MIT and Kyoto Institute of Technology. This is the first experimental VDS project in Japan. The design subject was to design the urban monument in Kumamoto City. Three teams were made to compete with one another. Each team consisted of each three students from each university. Web homepage, e-mail and FTP were used for asynchronous communication and exchanging the design information via the network. In design presentation, three teams made the proposal homepages to show their works and the several online jury meetings were held using the desktop-videoconference and application sharing software.

3.1.2. *Asynchronous Design Environment*

Each member of three teams is distributed in separated place and different time zone, so homepage, e-mail and web message board is commonly used for asynchronous communication. Three web servers are set up in each university and students have to edit the HTML documents by themselves to register his proposal on the homepage in each web server. Then he makes it notice to other by e-mail or web message board. The asynchronous design environment of VDS96 @ Kumamoto is illustrated in Figure 1.

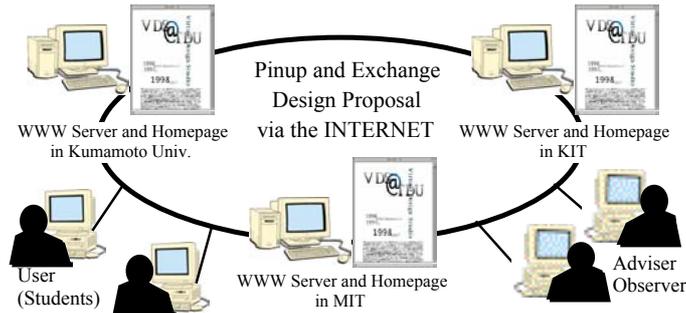


Figure 1. Asynchronous Information Management using web in VDS'96

3.1.3. *Synchronous Design Environment*

For synchronous design activities, we used the desktop-videoconference and application sharing software to support group interaction among the distributed universities. The desktop-videoconference system enables us to extend the shared workplace over geographical distance by overcoming the limitation of physical separation. The low-quality videoconference tool, such as CU-SeeMe, is generally used for the ad hoc meetings to make up the communication with e-mail. We used the high-quality videoconference system to share the visual interaction among three universities in the network design jury. The synchronous system environment is illustrated in Figure 4.

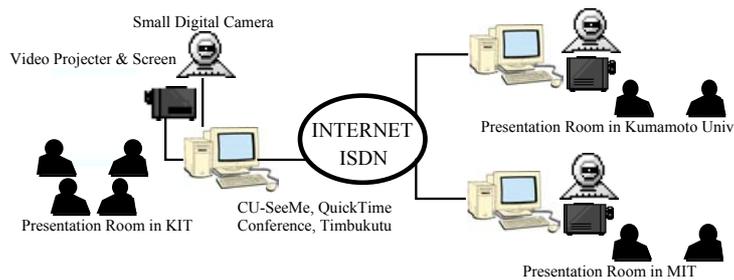


Figure 2. Synchronous Design System Environment in VDS'96

### 3.2. VIRTUAL DESIGN STUDIO'97 @ TDU

#### 3.2.1. Overview

This VDS project was executed in 1997 between Tokyo Denki University and Kyoto Institute of Technology. The participants were five students in TDU, some technical staffs and advisers in KIT and TDU. Each student had an individual homepage to update his design proposals. Advisers could review their design proposals in any time and send any comments or advises with e-mail. Furthermore, face-to-face design meetings were held every two weeks, advisers and students pinup and discuss about their presentation on multimedia homepage.

#### 3.2.2. Asynchronous Design Environment

The purpose of this project is to inspect the problems of virtual studio against physical studio. Student's homepage is as the personal sketch book and design desk to pinup and show their proposal. The common homepage of project is used as the gateway of virtual studio, which stores common reference information and adviser's jury comments. The system environment of remote design activity is illustrated in Figure 3.

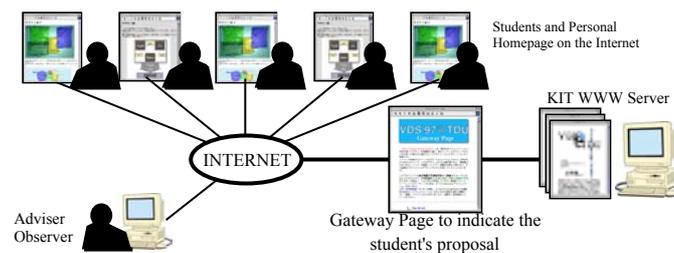


Figure 3. System Environment of Remote Studio in VDS'97

#### 3.2.3. Synchronous Design Environment

For the design jury, we equipped the meeting space in TDU with a set of video projector, large screen and PC to browse and share the visual images of student's proposal on the Internet. The adviser had the face-to-face meeting there every two weeks. All of the presentation data and proposal images were displayed on the individual homepage and checked by adviser before the actual design jury. So it was not needed to support the interactive network communication, because of the participants were not separated each other.

### 3.2. SYSTEM REQUIREMENT

In both of the VDS projects, homepage presentation and e-mail are efficient

communication methods for design collaboration. But it involves so complicated procedure to edit and update the homepage in portion to increase the amount of homepages. In the VDS'96 @ Kumamoto, three team's homepages are separated into three different web servers and updated at random. It is difficult for students to get the current proposal that is just updated. Then it is too troublesome for adviser to manage the distributed data in each three universities. E-mail was commonly used to contact each other but it was problem that these asynchronous notifications and discussions were not recorded automatically in the project's homepage. In the VDS'97 @ TDU/KIT, to pinup his proposal to his own homepage, they must edit HTML documents manually. Each document's format was not unified and the method to register was not easy and integrated as database.

So it is needed to support to search for newly arrived information efficiently and store them as the unified format in data archive on the distributed network without complicated procedure. To be shared and referred the registered information via the network, these system is working on the web homepage.

#### **4. System Development**

Through the results of two typical VDS projects, we intend to build up the experimental information system environment, which is possible to integrate the distributed information around the network. Then we have applied our prototype system for practical design studio, the Virtual Design Studio'98 @ TDU/KIT, with Tokyo Denki University and Kyoto Institute of Technology.

##### 4.1. OVERVIEW OF VIRTUAL DESIGN STUDIO'98 @ TDU/KIT

The participants are twenty-four students from TDU, six students from KIT, four design advisers, several technical support staffs and observers on the Internet. The six teams were made from each universities' students and team members are separated into Tokyo and Kyoto. So each student work together on the network. The period of this class is about three months.

##### 4.2. IMPLEMENTED SYSTEM ENVIRONMENT

We have constructed the web based information management system environment, which consisted of several applications, combined useful technologies and our own-developed tools.

##### *4.2.1. Homepage Design*

The project and team homepages are designed and structured as the primary working place for each team. The project homepage in web server of KIT is used to announce the common schedule and guidance from advisers to students. It

consisted of the several columns, 'Program', 'Notes from Adviser' and 'Team Homepage Index'. The column of 'Notes from Adviser' is the adviser's message board to update the irregular notifications. The column of 'Program' is the scheduled procedure and reference information about design collaboration. The team homepage contains the member's profile, team's introduction and three digital pinup boards we have developed.

#### 4.2.2. Notice Board and Design Pinup Board

In this project, to record and observe all design process and collaborative activities, students were prohibited to contact other members with e-mail and telephone. So we prepare the web based messaging tools to support the asynchronous interaction among the students, advisers and observers. The mainly developed systems in this project are the Notice Board and Design Pinup Board. Each board system is consisted of CGI scripts that are programmed with a commercial CGI development tool and web based relational database application. A set of Notice Board and Design Pinup Board is set up for each team, so they can refer and write any comments in these boards on their team homepages. The diagram of system components and data flow is shown in Figure 4. The Notice Board is asynchronous message board and text chat tool to support the rapid interaction among team members. So user is only requested to input text message and title without images. The comments are updated to the team Notice Board and stored in database automatically with the additional information, such as the date and user's name. The Design Pinup Board is used to register and exchange the multimedia data without editing HTML document on the Internet. When user wants to show his schematic idea visually, it is possible to register these data that contained visual images as thumbnail icons. So user can pinup visual proposal in the Design Pinup Board only to input the title, comments, URL of thumbnail image and linked homepage. The registered data are sorted by time order with the thumbnail images that explains the content of them. The captured image view is shown in Figure 5.

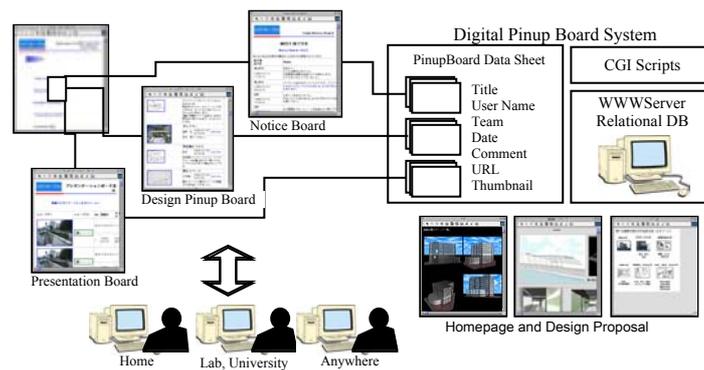


Figure 4. Pinup Board System and Data Management in VDS'98

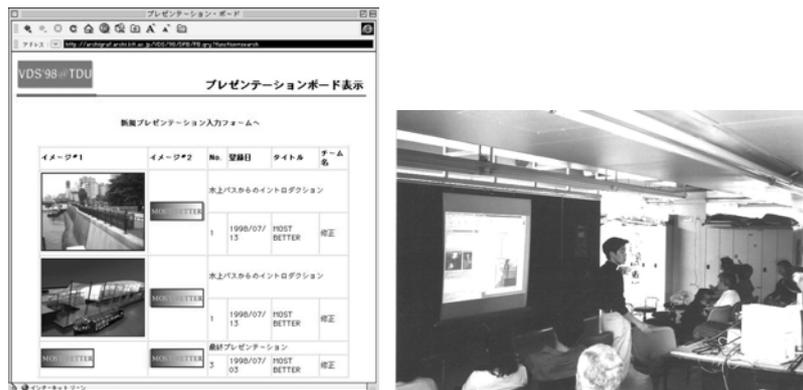


Figure 5. The Notice Board (left) and Design Pinup Board (right) in VDS'98

4.2.3. Network Jury Environment and Presentation Board

The system environment of design jury consisted of free desktop-videoconference tool, Microsoft NetMeeting and web homepages. The design jury rooms of two universities are connected to each other and opened to public for guests to join our design jury via the Internet. In the final presentation, the two guest advisers of Kanazawa Institute of Technology and Miyagi University joined and had an interactive discussion about students' works.

We have used multimedia homepages for design presentation, sharing them between the distributed two universities. So it is necessary to pinup a lot of presentation pages on the Internet. So we prepared the Presentation Board that is the editable pinup board tools to register the team's presentation pages. It records the proposal titles, date, comment, thumbnail images and URL of submitted presentation pages. The captured images of Presentation Board are shown in Figure 6.



*Figure 6.* The Presentation Board (left) and Photo of Design Jury (right) in VDS'98

## 5. Results

After this project was finished, we investigated about teams' design activities and actual use of pinup board system to evaluate our developed system environment. We research by the questionnaire survey for students and analysis of registered information in three pinup board tools.

For students, the structure of team homepage and navigation is so useful for almost of students and they generally used homepage and pinup board to exchange and show their design proposal. Almost all of them checked the Notice Board every a few hours and note their comments every day instead of e-mail and telephone. The major contents of the Notice Board are ad hoc design discussion and making a plan of meeting and taking a responsibility of team's design activities. Then they check the Design Pinup Board every day and register their proposal every few days, because it takes a lot of time to make a plan rather than use the Notice Board.

For project manager and adviser, these pinup board tools are efficient to manage the distributed data around the network. All proposals and information registered on the web are recorded as the Uniform Resource Locator in data archive. The database system manages only URL information of each proposal. But in last period of this project, these pinup board tools are slow to respond to pinup proposals because there are not enough capacity to record too much URL information.

The desktop videoconference tool was used for team meeting and common design jury between two universities. But the quality of videoconference is not sufficient to display detailed drawing and sketch. So they generally use it as web phone without videoconference. On the other side, we consider that it is important to know the situation and atmosphere of each presentation room, so videoconference is efficient for the interactive design jury on the network.

## 6. Conclusion

In this paper, we report three experimental VDS projects that we have executed since 1996 and evaluated each system environment and distributed data management method on the network. Then we have developed the web based information system environment and applied it to the Virtual Design Studio'98 @ TDU/KIT. The proposed system environment is composed of a set of homepages to indicate the required information for collaborative design, team homepage as common workplace on the network, web based pinup board tool to register the design proposal easily and network jury environment to share the

space among the distributed participants. We consider that the digital pinup boards are useful tools to exchange and manage the distributed design information via the Internet. In our system environment, adviser is able to observe and educate students who are separated from each other. We have verified that the system environment in the VDS'98 @ TDU/KIT is very efficient but most of students answered that it is obscure to succeed the design collaboration and presentation via the Internet between two universities. Because the design method and style has not been cleared yet. Then we consider that it is necessary to establish the actual design protocol on the network.

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