DESIGNMAP A framework for a design environment through networking

Yoshiro Kobayashi / Wael Abdelhameed / *Arizona State University, School of Architecture and Landscape Architecture, PO Box 871905, Tempe, AZ 85287, US* ***/ ykobaya@asu.edu /*** *South Valley University, Faculty of Fine Arts at Luxor, Egypt.* ***wael.abdelhameed@gmail.com***

Abstract *. The research endeavors to investigate the approaches and applications made in areas of online communities and forums in order to benefit from. The research proceeds to present an innovative contribution that could be described as a visual design library, a visual design community, and a novel use of networking in designing. The fields investigated by the research are: Online Communities and Forums, Networking and Collaborative Design, and Online Design Environment. The research contribution includes introducing a computer program called DesignMap that masters and presents a massive number of visual designs in two and three dimensions. The introduced software through its functions not only serves main applications of design disciplines of architecture and urban planning, but also combines significances of the investigated fields. Three comprehensive goals are investigated and introduced through this research: First, the proposed program is a means of getting architects and urban planners, who typically work in the domain of computationally introducing the design environment, involved in the creation and exploration of their designated forms for enhancing objects and spaces. Second, the program provides a design map for any architect and urban planner to search, visualize, modify, and then add designs through a wide range of form categories based on formal properties of objects relationship. Each user can have access to any part or category in this design map. Third, the research introduces the DesignMap as a tool to form and build up a networking community by bringing architects and urban planners with an interest in design area together to share in designing and to create design series.*

Inrtoduction The research starts with a short description for our motivation of creating the DesignMap, discusses related projects and research, introduces a framework of DesignMap, describes our concept and the outcome of the program, presents the main functions and the main panel of the program, and finally concludes with a summary of the future implementations and potential applications of DesignMap.

Motivation The motivation of this research is to introduce an online interactive design library in order to have a database of designs and design forms. This design library can be described as a Design Map that architects and urban planners can use in terms of searching for a specific design form in a certain category, modifying this design, and saving the new design in a corresponding category of the map.

The research attempts to present a computational tool that not only enables form generation and manipulation through modeling systems but also saves the created forms in series based on formal properties classification. This computational tool is also a design environment through networking, which is accessible by architects and urban planners through the Internet.

Related Research Work The areas of online communities and forums, networking and collaborative design related to our research concern have been investigated by many researchers; however, the research presents the main contributions made in these foregoing research areas, in order to manifest the novelty of the research contribution. The research introduces novel applications in these areas as an innovative avenue through a design environment.

ONLINE COMMUNITIES AND FORUMS In areas of Online Communities and Forums, many researches introduce different ways to share various kinds of data through the Internet between users who have a long distance separates them. The latest contributions in this area are:

Heylighen, Casaer, and Neuckermans (2005) developed Dynamic Architectural Memory On-line, an interactive platform to share ideas, knowledge and insights in the form of concrete building projects among designers in different contexts and at different levels of expertise. They found that interaction with various user groups revealed this platform to suffer from few thresholds. They proposed to conceive the platform as an associative network of projects, and developed ideas about how the relationships in this network can be determined and updated by exploiting the insights implicitly available in the project documentation and user interactions (Heylighen, Casaer, and Neuckermans, 2005).

Laepple, Clayton, and Johnson (2005) maintained that data collected from real-world projects using Web-based communications and project management systems, provide quantitative evidence for characterizing the design process.

Ise, Homma, and Iki (2006) introduced how to adopt the knowledge management in planning a city master plan and to develop the systematic tool for the consensus decision-making in planning. For citizen participation, it is necessary to represent the process of an argument by arranging the information and ranking them. This presented tool supports a resident group for making a city master plan (Ise, Homma, and Iki, 2006).

Huang, Krawczyk, and Schipporeit (2006) proposed that a methodology could be developed by collecting and evaluating client's requirements with web technology. The proposed model present a process of providing mass-customized prefabricated housing based on computer-aided design and a web-based product configuration system (Huang, Krawczyk, and Schipporeit, 2006).

NETWORKING AND COLLABORATIVE DESIGN Of the early prominent researches in areas of Collaborative Design and Networking, the Sasada Laboratory has introduced the networked version of Open Development Environment (NODE), by presented how to extend the architectural studio into cyber-space, through collaborative design and the integration of the Internet (Comair, Kaga, and Sasada, 1996).

Kepczynska-Walczak (2004) proposed a discussion on sharing knowledge and experience in the field of digital preservation between universities which are members of eCAADe organization, through investigated preservation metadata formats, and information management comprised of a set of four inter-linked stages: creation, storage, dissemination and re-use (Kepczynska-Walczak, 2004).

In collaborative design, Matsumoto, Kiriki, Naka, and Yamaguchi (2006) proposed the collaborative design education program on the web based on "Plan-Do-See cycle" process model, and developed the special Design Pinup Board system for running it. The introduced program focuses on very limited environment; distributed collaboration beginners, asynchronous, first meeting, and plural teams (Matsumoto, et. al., 2006).

Rügemer (2006) maintained the considerable enhancement of the design development, construction document, and construction phase, by the employment of digital media as a communication and information tool. The process demanded a highly articulated project description in text and images that were refined and exchanged daily; therefore, this helped to strengthen the cooperation between the design team and the project consultants toward a more team-related and democratic structure (Rügemer, 2006).

Murakami, Morozumi, Homma, and Onishi (2006) described a new function for collaborative design team, by developing the information exchange and sharing system, and making an improvement on it through the collaborative design studio.

Yamashita et al. (2006) developed a collaborative design environment which considers Information and

Communication Technology and architectural space. A computerized prototype environment for collaboration was proposed to attempt to support synchronous design collaboration in a face-to-face meeting at a local site and also in a continuously connected project-room at distributing sites (Yamashita et al., 2006).

ONLINE DESIGN ENVIRONMENT The main contributions made in Online Design Environment area, were limited to share various kinds of data through the Internet, which are related to the design process or designs at hand, as the following examples display:

Web pages and simple script, such as the digital bulletin board, are generally used for the network collaboration; however, these systems require the extra work for designer to present his proposal on the web (Kawasumi, Morozumi, Shounai, and Homma, 2001). Consequently they proposed the Visual Pinup Board that is possible to handle the registered design proposal like the actual pinup board and it can be used with common web browser (Kawasumi, Morozumi, Shounai, and Homma, 2001).

Chien and Shih (2000) developed a web environment to support the customization process of construction and enable efficient management and timely exchanges of information. The environment provides three levels of design interaction to encourage user participation in a controlled customization process (Chien and Shih, 2000).

Elger and Russell (2000) present a Net-Studio that is a virtual design studio where the environment for presentation, criticism and communication is web based. This allows lessons learned from research into Computer Supported Cooperative Work to be adapted to the special conditions indigenous to the architectural design studio.

Jung, Gross, and Do (1999) introduced the 'Redliner' which lets design team members browse and leave text annotations on surfaces in three- dimensional models. They developed their research further in 2001 and 2002 introducing 'Space Pen' an annotation system with improved interaction capabilities that goes beyond the post. It allows users to draw in and on the virtual environment, and 3D web models (Jung, Gross, and Do, 2002.)

Madrazo (2000) proposed utilizing the web as a medium in a pedagogic work concentrated on representation in architecture education. A web based learning environment 'Networking' has been created, which allows students to perform a variety of collaborative works: drawing visual and linguistic relationships, developing further the works of other students, and participating in collective processes of form generation and space perception (Madrazo, 2000). Madrazo (2001) proceeded to present a customized 'Networking' environment for each one of the six themes that made up his course: text, shape, object, image, space and light.

DesignMap Program To give a sense of how the users will benefit from and accomplish through the introduced map, and to frame our description of the program, we begin by briefly describing the applications, from concept through execution and documentation. The DesignMap, which explicitly introduces three dimensional designs that are categorized according to their formal features, allows its users to explore and modify design forms by implementing and introducing an interactive design environment represented in a design map through networking.

METHODOLOGY AND CONCEPTS

The DesignMap program written in Java language, allows its users to upload their own algorithms of Max Script (3d Max language) to create their own designs, as well as modify the displayed designs, Figure 1. The DesigMap presents a comprehensive approach to support navigation in the proposed generative design environment. This approach takes account of studies related to human spatial cognition, and information navigation in online environment. It contains a general model of design space, basic navigation operations, and principles for designing navigation support. The basic operations facilitate navigation activities in the introduced design map. The program functions aim at guiding users in creating their needs of individual design systems through the presented online design environment.

Methodology Through the methodology used in system implementation, three main objects are defined: Space, Design and Subspecies. Space is a class

of a list of cells occupying in a grid. Each space has one property index number assigned from predefined list such as 0 for OPENSPACE, 1 for BUILDING, and 2 for GREEN AREA. Design is a class of a list of spaces, and is represented as an individual node in the designs layout. Subspecies is a class not for a new deign but for the design whose topology is not changed from the parent design. A new design is generally generated when a new set of spaces or a new neighborhood of conditions is created from its parent design. For example, when the size of space is changed without changing any relations to neighbor spaces, a new design is not generated but a subspecies is.

The lists of all spaces, designs, and subspecies are saved in a file.

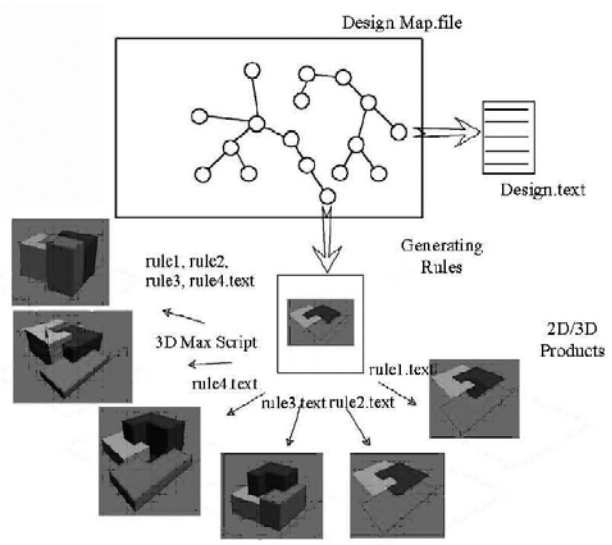

Figure 1 ***Concepts of DesignMap***

In DesignMap methodology, topology issues are created through a special rule to check if a new space layout design can be a new Design or be a Subspecies.

The rule is described as follows:

1) Calculating the adjacency list for each space. If a space whose ID is 1 is adjacent to space 2, 3, and 4, the adjacency list will be {2, 3, 4}.

2) Modifying the design layout. If the adjacency list does not change, the output is registered as a subspecies. Otherwise, the design is a new Design.

3) In the previous process number 2, if the adjacency list is changed with more than two items at the same time, the modified design is not allowed to be added to DesignMap. This two-items-change design can be added to the map only when an additional design with one item change is added before it.

Concepts Main DesignMap concepts are to:

1) Create network application to share the design without least words for users all over the world. Using no word, depending on 2D and 3D drawing, is the main idea.

A database is created which everybody can understand with a single glance.

2) Enable the users to search, modify, add, and categorize, without words but with design (a set of spaces). Design is beyond the words, and topology is the core item to implement these tasks.

3) Generate a huge number of designs of any particular function. For example residential houses, including driving way, back and front yard, garage, house, pool, trees, etc., one designer can create 1000 patterns. For creating 1,000,000 patterns, it is not feasible effort for one person, but it can be possible by contributors all over the world.

FUNCTIONS AND APPLICATIONS

DesignMap acts as a tool to store a massive number of designs in both two and three dimensions, implementing in a design map that emphasizes form generation through online design environment, collaborative design, and networking. Each design is represented in a node; a new design can be generated and then added to the map when a new set of objects and new condition of objects relationship is generated and created, Figure 1 and 2.

DesignMap is programmed as a Portlet running with JetSpeed2 framework provided by Jakarta Project,

Figure 3. The portlet can be run under any kind of Portal application.

The processes used in DesignMap are:

1) Initial Condition: The user must prepare two files. An initial space layout file and a file of space property list. Space Layout file should have at least one design with an array of 400 (20x20) integer numbers such as (0 0 0 0 1 1 1 …. 0 0 0). Each integer number represents a space property such as 0=OPENSPACE, 1=BUILDING, and 2=GREEN AREA, which are defined the file of space property list.

2) Add Design: The user can add a new Design from one existing one on the map. First, the user selects one exiting Design as a parent design. Then, the editor panel to modify the design pops up. The modified design is checked if it can be a new Design or a Subspecies by calculating topological changes. If it is a new Design, the layout is posted on DesignMap with a link to the parent design. Otherwise, it is registered as a Subspecies and shown under the parent design.

3) Delete Design: The user can delete any design in DesignMap. As Wikipedia allows any user to add, modify and delete any contents, DesignMap has the same concept and functions.

4) Generating 3D models: DesignMap provides only the list of space layout designs. The other Portlet provides a list of generation files, which any user can post the file to generate 3D models from any space layout design in DesignMap. In short, the process to generate 3D model is to:

- Select one design, multi designs or all designs in DesignMap,
- Select or create generation rules,
- A 3D model is generated for each selected de sign, and finally
- The models are saved as 3D formatted files.

Conclusion In view of the foregoing concepts and the introduced functions of DesignMap, the research has analyzed the usefulness of the proposed framework that presents a tool as a Visual Design Map, an Online Design Environment, an Online Community, and Networking Collaborative Design.

DesignMap has potentials to be employed and implemented into various applications into the fields not only investigated by the research but also related to

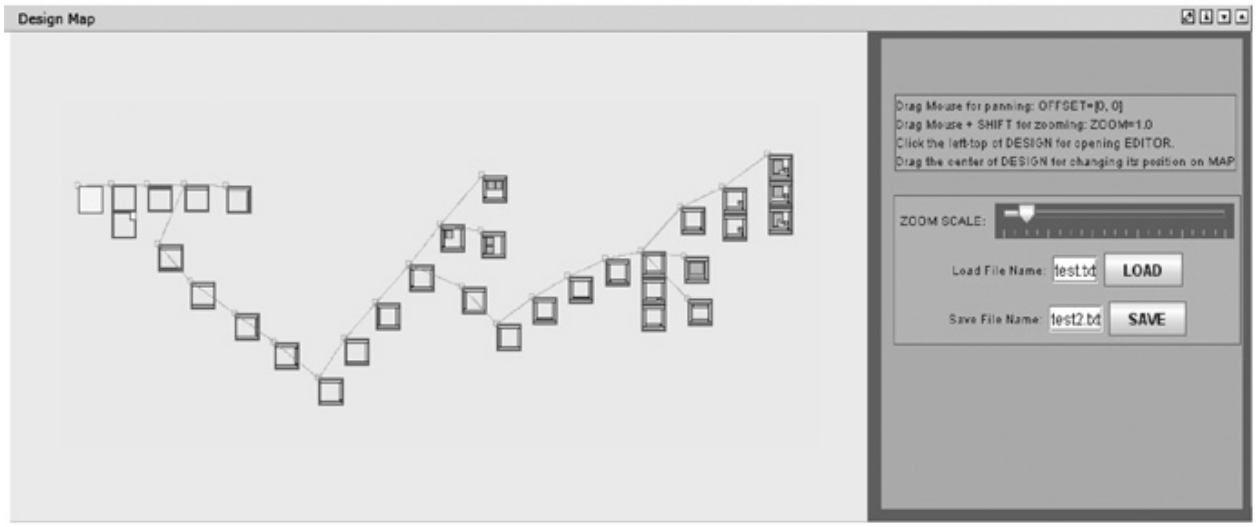

Figure 2 ***DesignMap Program, the Main panel displayed the represented designs in nodes***

architecture and urban design realms. Results that are introduced and classified prove the effectiveness of the proposed framework and approach.

The approach provides the foundations for a seamless continuous designing environment for architects and urban planners through an innovative online modeling system, an integrated designing framework, and a novel visual design library.

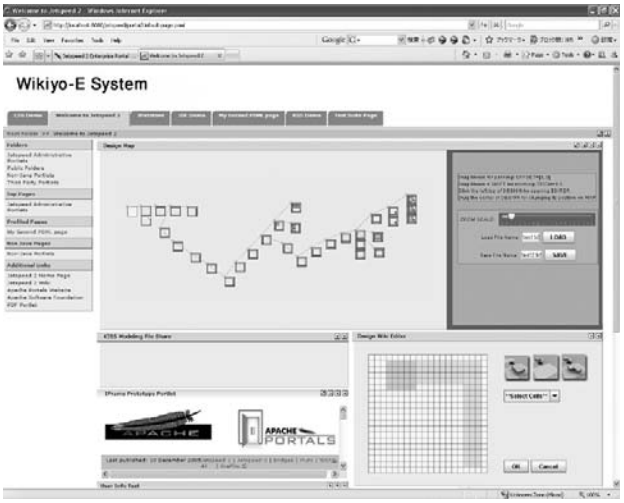

Figure 3 The Main window of the Portlet running with JetSpeed2 framework provided by Jakarta Project, displaying the DesignMap Main panel and the introduceded modeling system

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