Ubiquitous Social Computing Technologies to Foster Design Thinking and Creativity

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ABSTRACT

Design thinking using studio-based models of education has been proved over many years to foster creativity and innovation in the field of architecture [7]. Some researchers in computer science (CS) have already experimented with this model [4], [5]. Nevertheless, the potential of interdisciplinary work and informal interactions enabled through ubiquitous social computing (USC) applications in fostering creativity among undergraduate students in the computing disciplines remains under-investigated. We are working on a new type of interconnected, interdisciplinary and collaborative design studio to foster creative problem seeking and problem solving using ubiquitous social computing. In our studios, students from multiple colleges and departments, such as computer science, information systems, architecture, engineering, and management, will form interdisciplinary teams and use collaborative cyber-infrastructure to explore and address key socio-technical challenges in USC.

Keywords

Studio Teaching, Ubiquitous Social Computing, Large Public Displays

INTRODUCTION

In recent years there has been a growing recognition that the design of information systems and technology may benefit from lessons learned and approaches in architecture and industrial design [4]. We argue that we can improve information systems design and foster appreciation for ambiguity and creativity that will lead to novel design solutions by leveraging other disciplines and cross-fertilizing diverse, yet related, design fields. Our visions is that applying the architecture design approach embedded in studio learning to computer science may offer an environment to expand the structured boundaries of traditional information systems design. The use of ubiquitous social computing technologies to enable this type of collaboration in formal and informal learning environments may support novel, richer and more creative learning experiences and outcomes.

USING USC TO INTEGRATE ARCHITECTURE AND COMPUTING SCIENCES STUDIOS

Some research points to studio-based educational settings as possible catalysts for fostering creativity and complex problem-solving [1], [2]. However, given the dearth of evidence and its mostly anecdotal nature, a more systematic approach and additional exploratory experiments are needed to verify the effects of various collaboration technologies on creativity and design innovation. Our approach of integrating architecture and computer science design studios with communication and collaboration technologies that support physical (co-located), educational, and social interactions is a systematic attempt to understand if the interplay among collaboration and communication technology and the multi-disciplinary studio model support more creative software development experiences.

The cyber-infrastructure for these studios will adapt and expand our SmartCampus location-aware mobile community test-bed. The students will use these devices to design, implement, and evaluate social computing applications that facilitate interactions between colleagues, friends, and even the entire campus community. A key characteristic of these studios is the use of large-screen context-aware interactive plasma displays installed in the interconnected studios and across the campus to continuously exchange information between students enrolled in the studios and the rest of the university community (Fig. 1). For instance, interested community members can leave comments or questions on the interactive displays, thus actively participating in the applications' design. In this way, rapid prototyping and early feedback will help students to refine their design and come up with novel solutions to non-envisioned problems. Because of collaborations with architecture students and others, we expect that by the end of the semester, students enrolled in these studios will design and implement novel digital/physical systems and applications that take into consideration broader issues such as the relationship of technology to physical context, ergonomics, and human behavior.

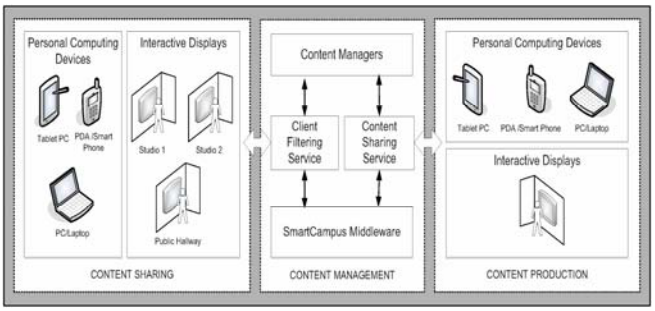

Figure 1. Interactive Poster Information Exchange in our USC

Collaboration Technologies

SmartCampus is a USC test-bed created by a diverse team of faculty from the departments of Architecture, Computer Science, Electrical and Computer Engineering, Information Systems and Management at NJIT. It serves as a dispersed laboratory for the study of USC applications, in particular systems that link People-to-People-to-Places (P3-Systems) for 1) community building; 2) co-ordination of mobile teams; 3) privacy of personal location data; and 4) security. P3-Systems are of particular relevance to face-to-face educational settings because they can transform traditional educational environments by dissolving boundaries between digital, physical and social spaces and can help motivate both online and face-to-face community participation.

We propose to use SmartCampus-based technologies to connect and blend digital, social, and physical spaces into a common inter-disciplinary educational space. By adding connecting large interactive displays to the SmartCampus test-bed will give students serendipitous community interactions in an educational setting that will allow them to explore and receive training in USC. Large-screen systems can also be used to increase informal interactions, through any of five basic interaction approaches, as: (1) Community Notice boards; (2) Media-Spaces; (3) Community Awareness Systems, (4) Walk Up and Use Personal Interactive Public Interactive Surfaces, and (5) Proactive Displays. To integrate the interactive public displays in the SmartCampus system architecture, we are transforming the current Plasma Poster client-server architecture [3] into a service oriented architecture similar to the one used by SmartCampus. The new architecture for content sharing is broadly presented in Fig. 1. The posting infrastructure will be abstracted into a content sharing service. This service will receive requests from a multitude of client applications that need to publish cyber-infrastructure educational information on the public displays. For instance, an instructor may use her/his PC to post an interesting article, and subsequently, a student can read this article and post a question using his/her SmartPhone. Furthermore, new content can be generated by users interacting with the display. To simplify the content management, users are asked to annotate the content with meta-data. Where possible meta-data will be automatically extracted and leveraged for content organization, indexing and filtering. The meta-data is used by the content filtering service that decides in real time what type of information to display on each individual plasma display.

Our proposed design of architecture and CS studios closely interacting 'side-by-side' either using face to face meetings or coordinating progress through virtual and interconnected displays intends to generate more opportunities for the achievement of creative outcomes. On the computing sciences side we will use the scenario based usability engineering approach to structure the studio work [6]. This HCI approach is well suited to studio based teaching, with its phases of analysis, design, prototype and evaluation. This will be complemented by the use and teaching of various complementary techniques such as paper prototyping, storyboarding, etc.

WORK PLAN

We are currently conducting our first pilot of interconnected architecture and computing sciences (CS, HCI, IS and IT) studios to explore the pedagogical approach, integration and understand preliminary outcomes. Students are researching the use of large interactive displays and associated social networking software. They are analyzing the best locations for the placement of these displays and then use them in the course of their design work. Given that the pilots are underway, only preliminary and anecdotal results are available. We have been successful in linking studios that are (a) *interdisciplinary*; (b) *interconnected* through a variety of communication and visualization tools; and (c) *freely interactive* by leveraging multiple means of formal and informal exchanges among the students involved. Interdisciplinarity has been achieved by conducting the studios with highly diverse student populations. Teams in the CS studio have been assigned multiple design and development projects and have completed literature reviews, design reviews and project mock ups by eliciting feedback form the students in the architecture studio. Collaboration has been achieved primarily through face to face meetings, instant communication devices and emails as well as joint review sessions.

Starting from Fall 2007, studios will also be connected through interactive plasma displays placed in each studio, and later through the campus community through public plasma displays which will be conveniently located on campus to solicit both casual and formal interactions from passers-by (i.e. asking real-time feedback on design, usability, usefulness, etc.). While it is still premature to articulate outcomes, results from the experiences will be captured through open-ended interviews at the end of the semester and will report on the perceived learning, social and design outcomes. They will also guide the refinement of future studio along with in depth field studies.

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