(Inter)facing the Wall-Integration of digital and building technology

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The paper examines possible transformation of an existing school info-board massive brick wall in the building entrance area, into a 'Smart' one, combining electronics, internet, IT and computer graphics with building technology. The project as a whole aims to improve communication and interaction between users within one building and to provide the reliable visual information which influences users' activities in real-time.

Keywords: *'Smart' wall; real-time; interaction; information visualization.*

"Architecture is defined by the actions it witnesses as much as by the enclosure of its walls."
Bernard Tschumi

Introduction

Advances in information technology offer new opportunities to architecture built using traditional materials, which could be augmented and become interactive with users within it. (Addington and Shodek, 2005) The project proposes conversion of an existing school info-board massive brick wall into the 'smart' one and thus presents new applied visualized information in terms of dynamically updated element of interior. The aim of the design proposal is to improve communication and visual information of interest as well as interaction between users in a building.

Design proposal

The wall has been chosen for its rigid historical meaning (symbolizing protection, defense, segregation, etc). Grounded in the concept of Ubiquitous Computing (Weiser, 1991), the idea of the project is related to works based on "background processing" (Ishii and Ullmer, 1997) and informative art (Mynatt, 2001).

Surveillance of human activities, needs and problems within a building and their usage of the building's parts and elements is the first step in rethinking and improving a building's functionality. Subsequently, three kinds of users' daily activities were analyzed as follows:

1. *Movement* – students leaving the school building (to catch the next bus to the city). Problem: buses are not frequent, especially in the late hours. Students and staff have to plan to go to the bus-stop at least 7 minutes before the next arriving bus. Accurate information on the bus-stop display (dynamically updated by the local traffic company) is not visible from the building. A bus schedule posted on the info-board wall is too small to be visible from the students' work-places. Idea: to merge informative displays

Figure 1
School info-board wall in its current state

on the bus stop with the info-board wall in the school building as an informative art piece, metaphorically presenting human 'extended senses'. Please note that position of the wall in the entrance area is visible from the working places of students;

2. *Work* – perceiving presence of students and staff while working in front of computers on their working places. Problem: absence of information on who is in the building. Idea: 'indoors window' in the form of interactive mosaic offering information about perceived working students and staff.
3. *Communication* – students' usage of printed information posted on school info-board wall. Problem: the majority of information displayed on the info-board-wall is either very old or not updated. Idea: digitalized message board for both individual and collective notes.

The concept of the project has been developed to make info-wall surface more useful to students and staff; offering three informative sections (Figure 2)

Zone 1: Informative light display – applied "traffic-light" system provides information about next bus to the city. The displayed color (green for the optimal time to go to the bus station to catch the next arriving bus, yellow if there is some probability to catch it, red when it is no longer possible to catch the next bus and grey for intervals meaning "plenty of time") is generated in specially developed software using information retrieved each ten seconds from dynamically updated web-site www.vasttrafik.se

Zone 2: Indoors' window – visualization of perceived presence of students and staff. The proposed system doesn't require any special action from

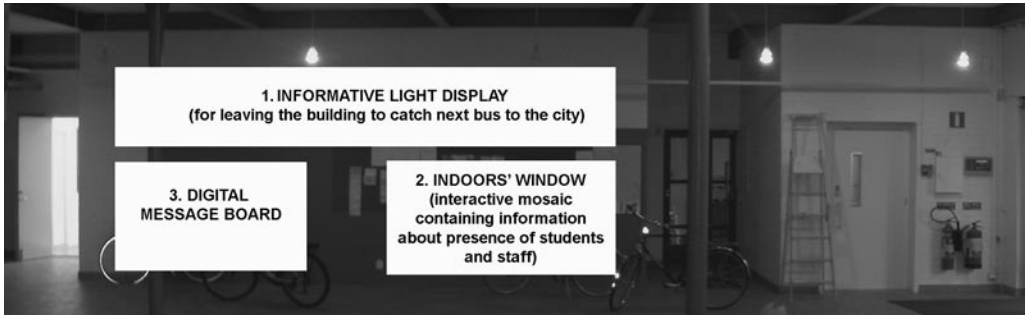

Figure 2
Design proposal for the info-board wall. The concept of three zones

the user. It is based on sitting on chair pressure sensors which send signals via parallel port of a PC to a specially developed program that checks non-stop if the chair is active. According to this information, the graphics is modified as a function of time (a square linearly increases its size in cycles of 30 minutes if a person sits on the chair. When the 30-minute-cycle is done, a red light blinks for a minute. If the user continues to sit on the chair, the square will change its color starting from white to black in each next cycle. After two hours of continuous sitting, the screen on the wall will blink red light constantly). The concept is based on ergonomically preventive advice for humans working with computers to stretch and change the position each 30 minutes. Thus, the information placed on the wall might be seen and discussed in three particular ways, as follows:

a. As an interactive art piece - mosaic, with unique composition in each unit of time;
b. With added list of people - to notice who is in the building (according to information on the activated chairs);
c. As an ergonomic alarm for students and staff to stretch themselves each 30 minutes.

Zone 3.: Interactive message board offers the possibility to communicate with other people within the building, composing, sending, reading, replying and forwarding messages to either someone or to everyone. This section replaces traditional message-board with protected private messages.

Special purpose software was developed using C and OpenGL for each of the informative sections. The LCD screens are embedded into the wall in all the three sections and a keyboard with a mouse is placed on a horizontal narrow surface in section 3 (Figure 3).

The wall composition consists of a horizontal shifting rectangular light together with playful interactive mosaic of "pixels" (squares) which present different indoors' "windows" gathered in synthetically cubistic composition (see Figure 3). The dominant element in the wall composition design is the altering color and size of the figures. The proposed composition is original, uniquely generated in each moment. To be comprehensible as an informative art piece, the rules are based on broadly accepted traffic-light color symbolism and principles of color design (hue, dilation, contrast) (Wong, 1997).

The Prototype

The functional prototype consists of a constructed model of the wall in scale 1:10 (Figure 4) and a chair equipped with pressure sensors (Figure 5). The two sections of the prototype have been tested. The students showed special interest in the section 1 - the "traffic light" for catching the next bus to the city. The

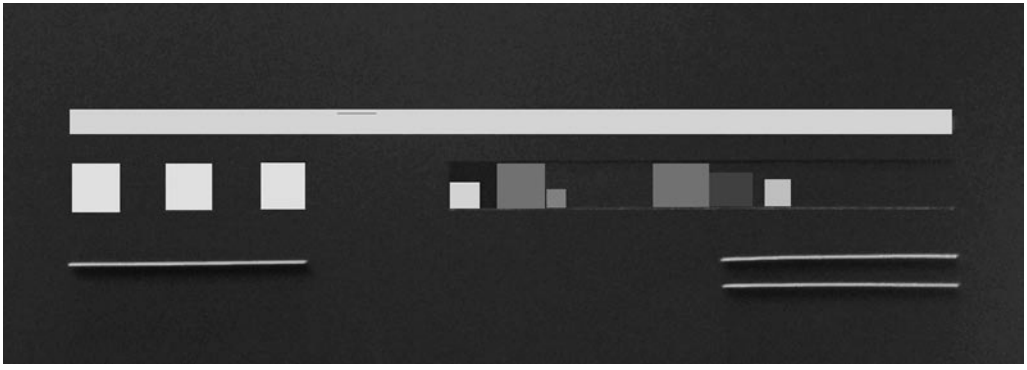

Figure 3
Design proposal for Info-board wall. Composition

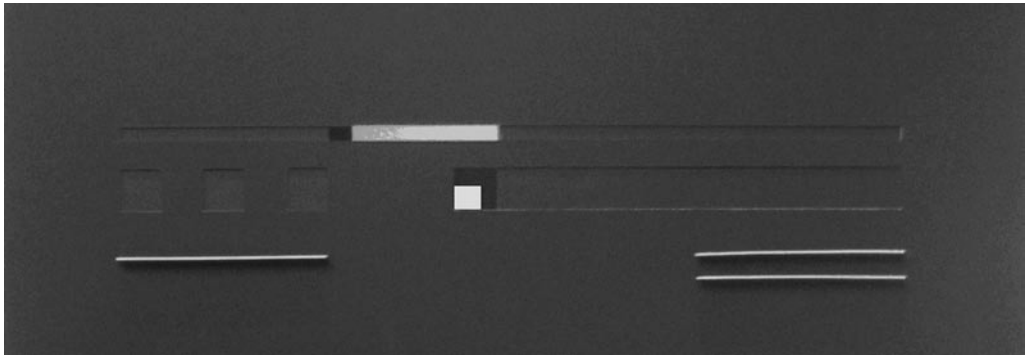

Figure 4
The functional prototype, a constructed model of the wall in scale 1:10

large scale application would be warmly accepted among students and staff. The section 2 has founded interested students. However, for the reliable evaluation on privacy issues etc, it is suggested to have it built in scale 1:1. The third section has not been tested yet. All the three sections have potentials to be developed as separate projects.

Conclusion remarks

The functional prototype presents reliable, functional and aesthetically original visualized information for the created system in the chosen context. The project suggests "background processed" visualized information, improving security and quality of daily information, communication and interaction between users within a building, based on concepts of extended senses, indoors' window and dynamically updated information in interior design. Application of the proposed project is viable as a whole or as separate projects in other contexts such as homes, offices, etc.

Figure 5
Chair equipped with pressure sensors

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