Mirrored Message Wall:
Sharing between real and virtual space

Jung-Ho Yeom
Architecture Department and
Ambient Intelligence Lab,
Interactive and Digital Media
Institute
National University of Singapore
117566 Singapore
jungho@nus.edu.sg

Beng-Kiang Tan
Architecture Department and
Ambient Intelligence Lab,
Interactive and Digital Media
Institute
National University of Singapore
117566 Singapore
akitanbk@nus.edu.sg

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Abstract
In this paper, we describe the Mirrored Message Wall as a public display to promote social communication and user participation. It exists in both physical and virtual space and is a bridge to connect users between the real and virtual worlds.

Keywords
Mirrored message wall, interactive public display, user observation, social interaction, virtual space

ACM Classification Keywords
H4.3 [Information systems applications]: Communications Applications --- Bulletin boards; H5.3 [Information interfaces and presentation]: Group and Organization Interfaces --- Asynchronous interaction

General Terms
Design, Human Factors

Introduction
With recent developments of technologies for interactive environment, such as sensing and wireless technologies, new communication services become smarter. Advancement in display technology has resulted in public display screen such as plasma, LCD, and LED screens being more affordable. There has been

a proliferation of digital display screens as a public display placed in public places such as shopping centers, office lobbies, university campus, and public buildings to provide news, life, event, weather, community information, etc to people. There is great potential for such public displays to become a medium for social communication among people in the public place and be more engaging for the people [3]. Public display also can provide opportunities for user to start a conversation [5], feel the sense of community [7].

However, most public displays are minimally interactive [2], difficult to use [4], and one-way dissemination of information by manager to passers-by [7]. Most of them lack public participation and are merely billboards for advertisement.

In this paper, we present the Mirrored Message Wall as a public display for large group setting such as a university community. It is proposed to promote people participation, allow user to post contents easily, provide materials as a talking point, promote a sense of community, and bridge the virtual user to the real space user. It is a platform to share the collective thoughts of a community whether they are in the real or virtual world.

Extend to the virtual realm

Use of 3D virtual worlds, such as Second Life, is increasingly popular and the in-world activities exist only in the virtual realm. Users are disconnected from activities happening in the real world physical space and people in the real world are not aware of presence of users in the virtual space without turning on their computer. In this project, we try to extend participation to users in the 3D virtual world. The virtual users could be National University of Singapore (NUS) students who are on exchange program overseas, alumni or internationals student who have returned to their home country. They miss the connection and interaction with other students in NUS. So, the extension to the virtual can be a means of communication between students who are in the physical campus and the 3D virtual campus in Second Life.

Second Life is the 3D virtual environment social network platform that is launched in 2003 by Linden Lab. It is a virtual environment in which most of the contents are created by virtual users [8]. Before the implementation of the Mirrored Message Wall, we tested communication between the real and virtual space using micro controller and sensors. It is possible to communicate sensor data between real and virtual space with sensor network technology. Web applications such as Pachube [6] helps users update or call the sensing data with low effort. For example, a controller in the real space can control a 3D object in Second Life. A user can change the color and move an object using physical controller. It is also possible to control physical objects from Second Life.

Mirrored Message Wall

The Mirrored Message Wall exists in physical space and virtual space (Second Life) and it is a bridge to connect users between both worlds (see the figure 2). The goal of this Mirrored Message Wall is to promote communication and awareness of presence between real and virtual space.

It consists of three main systems --- Message wall server, Physical message wall platform and Virtual message wall platform.

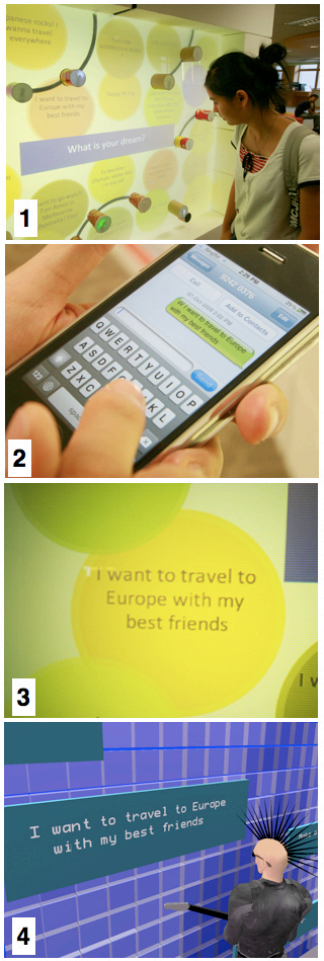

figure 2. Posting message using Mobile SMS

Message Wall Server saves the message and sensing data from the real and virtual space. To collect users' message, we use Short message service (SMS). SMS is most widely used and is a friendly communication service nowadays. People can use the Mirrored Message Wall without other extra device. When the (GSM) modem receives new SMS message from the user at the physical message wall, it is sent to the Message Wall Server. Both Mirrored Message Walls in real and virtual space will display the message anonymously whenever a new message is detected.

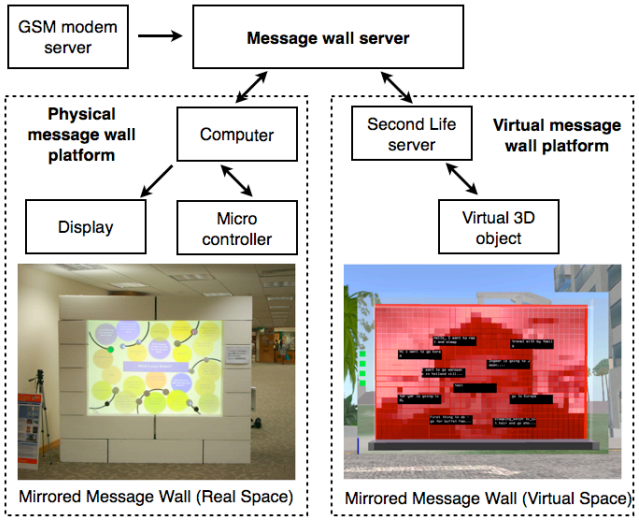

figure 1. Framework of Mirrored Message Wall

Sharing thoughts

A message wall is placed in a physical public space in the lobby of the NUS library. A virtual message wall exists in a virtual public space in our Second Life virtual campus. A different topic is shown on the wall each day or each week. In our field test the topic was "What is your dream?" In response to the topic, a user standing near the physical message wall can text a message to the wall. It will appear on the physical message wall and the virtual message wall at the same time (see figure 1). Conversely, an avatar in the virtual world can send a message to the virtual message wall and it will be displayed on the physical message world as well. Messages sent from the physical and virtual worlds are displayed with different colour background to differentiate their origin (e.g. green bubble messages are from the real space and blue bubble messages are from the virtual space).

Awareness of presence

The Mirrored Message Wall indicates presence of users in the real and virtual space. Though a real time video or photo of a person will show presence, we found that people were concern about privacy in the interactive media environment [9]. Thus, we use other simple ways to show their presence using pixelated image or shadows.

Pixelated tiles

Pixelated tiles are placed in Second Life to indicate the presence of people in the real world. A camera at the physical message wall takes a snapshot of people standing at the wall. The captured image at the physical message wall is processed to pixlels and each pixel value is sent to the message wall server. These pixel values change the pixelated tiles each time.

Figure 3 shows that the captured image from the real space is displayed on the pixelated tiles in Second Life. The virtual user who is in the Second Life NUS campus can get a sense of people present at the physical message wall at NUS library. This could be a medium to feel the presence of people in the real space from the virtual space.

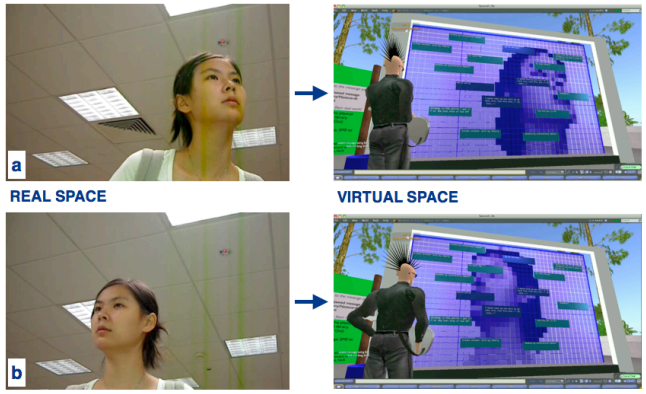

figure 3. Pixelated tiles: A camera captures image of people standing in front of the message wall and the image is pixelated and displayed as background on the virtual message wall indicating presence of people at the real world message wall.

Shadow tubes

The shadow tubes display an abstract representation of virtual users in Second Life in the form of shadows of various human shapes. The shadow tube comprises human-shaped paper cut-outs inside a tube covered with transparent paper. A shadow is shown when the LED light is turned on. To control each LED, Arduino [1] micro controller is used to get the sensing data. Each shadow tube's light is turned on when the virtual users are at the virtual message wall in Second Life NUS campus. If there is change of number of avatars, the number of shadow tubes lighted will change accordingly. So, the shadows will represent the number of users who are visiting the message wall at the moment. When people see the lighted shadow tubes in the real space, they are aware that there are active users in the virtual space. For example, if there are many shadows, it indicates a crowd in the virtual space, people will feel like going to the Second Life NUS campus to meet up with other people.

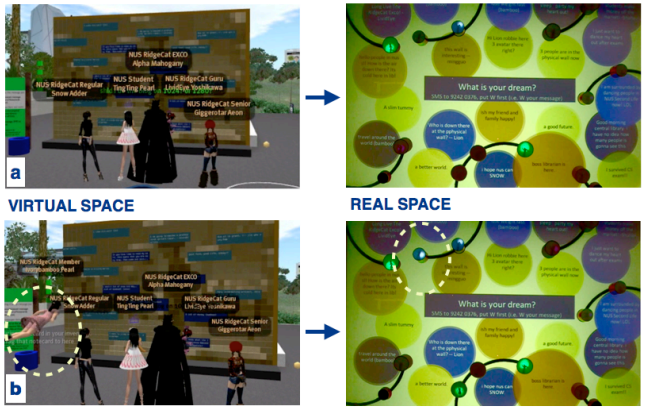

figure 4. Shadow tubes: It indicates how many users are in the virtual space using shadow lights.

Field test in public place

The implementation of Mirrored Message Wall was set up in the central library of NUS for 4 days. Over 120 students posted messages. A questionnaire was given out. It was designed to find out the user preference of using SMS, user attention and attraction, and user feedback. The results were encouraging with users

generally attracted to the Mirrored Message Wall and like the idea.

In the field test, we also collected data by interviews, video recording, and user observations. These will be analysed for improvement to the project.

Findings
From the field test and video observations, we found that many users were interested to see others' posted messages on the Mirrored Message Wall. When the user is accompanied by friends, it was found that they talked about the messages at the wall. Some users used camera phones to take photos of the message bubble they posted on the wall in order to send to their friends or to save it for memory sake. It was also found that some users in Second Life tried to talk to the users in the real world. It is very interesting that people tried to communicate with someone they do not know who is in another world.

figure 5 People are standing in front of physical Mirrored message wall to post and see the messages.

Conclusion and future work

Mirrored Message Wall is a public display for collective sharing of thoughts and messages in large group. It also extends participation to users of 3D virtual space. It collects the hidden thoughts of passers-by and virtual users and allows everyone to see the collective aspirations. We found it encourages user participation and social communication. People are interested to read messages left by others and the messages trigger conversations among people as they discussed about messages on the wall.

For future work, the Mirrored Message Wall could be developed with the following features: 1) Allow user to post content using a low effort posting method (e.g. handwriting), 2) have more interactivity to attract users, such as designing a controller to show previous messages and add voting function to choose the popular messages to display on the screen longer, and 3) Allow user to change display properties e.g. Sensing voice or movement can create different color of message bubble.

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