# Two-nearly: Moderate Communication of Awareness to Connect Families Living Far Apart

Mitsuhiro Sorakubo and Hiroyuki Umemuro

***Abstract*—This paper proposed a communication system that communicates awareness in a moderate way of family members living at a distance. This system aimed to convey awareness of family members without violating privacy, nor forcing active communication. A prototype of the system was implemented and evaluated by two groups of participants, each of which consisted of older adults and their children living in distant locations. The subjective evaluation by the participants as well as quantitative data of their usage suggested that the proposed system was to some extent successful in offering moderate awareness of remote family members.**

## I. Introduction

When older people are living independently from their family members, connectedness with family members is considered as a major factor to improve their quality of life (QOL). Being aware of how others are and what they are doing significantly helps to maintain their connectedness. This sense is known as *awareness* [1].

In the case that family members are living in geographically distant locations, various communication media may support their maintaining sense of awareness [2]. Whereas conventional media (e.g. postal mail) carried relatively weak awareness of counterparts, recent information and communication technology (ICT) has enabled to convey strong awareness (e.g. video conference). Although media that carry strong sense of awareness might be effective for cooperative work settings, strong awareness may also cause a psychological burden among users and privacy issues when applied in home settings. Furthermore, communication media with strong connectedness often require users active communication, even when they do not want to respond and participate.

This paper proposed a communication system that communicates awareness in a moderate way of family members living at a distance. This system aimed to convey awareness of family members without violating privacy, nor forcing active communication. The system was designed using the analogy of a window in the real world. A prototype of the system was implemented and evaluated by two groups of participants, each of which consisted of older adults and their children living in distant locations.

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Mitsuhiro Sorakubo is with the Department of Industrial Engineering and Management, Tokyo Institute of Technology, Tokyo, Japan (e-mail: sorakubo.m.aa@m.titech.ac.jp).

Hiroyuki Umemuro is with the Department of Industrial Engineering and Management, Tokyo Institute of Technology, Tokyo, Japan (phone: +81-3-5734-2246; fax: +81-3-5734-2947, e-mail: umemuro.h.aa@m. titech. ac. jp).

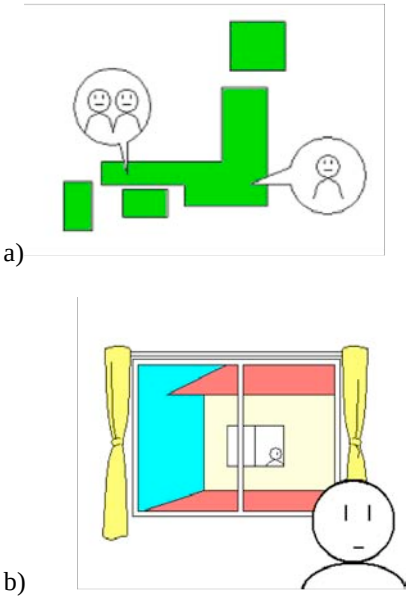

Fig. 1. Concept of the proposed system. Panel a): family members may live in geographically distant locations. Panel b): the house of remote family members could be seen through a window as if they were living next door.

## II. System Design

The system employed the analogy of a window in the real world. The concept of the system was that the house of the family members who are living in a physically distant location could be seen through a window at the present location (Fig. 1). Users could see the remote family members through the window as if they were living next door.

The users are not obliged to directly communicate or converse, but can still feel the awareness of each other: “He seems to be at home”, “She seems to be walking across the room, maybe preparing dinner”, and so on.

The line of sight is limited to the view through the window frame, and the audio is not transmitted constantly, minimizing privacy issues. When the user does not wish to be seen even through the window, the user can shut the curtain to cut off the view. On the other hand, when the user wishes to talk to the remote family member directly, the user can open the window and knock on the window glass of the remote house. If the remote family member is at home and agrees to talk, the remote user can also open the window and start talking.

## III. Implementation

The proposed system concept was first discussed in

focus group interviews with 16 older adults. Both negative and positive opinions obtained were reflected on improvement and refinement of the system design.

Then a prototype was implemented as a network system. Fig. 2 shows the external appearance of the system. A touch-enabled liquid crystal display (LCD) is installed inside a wooden window frame and displays the view of the "next-door" house. A small video camera installed at the remote site captures and transmits the view of the remote family members, using the video streaming technology over the Internet. The video image transmitted from the remote site is displayed at the position inside the large window of the house displayed on the LCD.

When the window is closed, voice communication is disabled; microphone and speakers are shut off. An exception is knocking. Even while the window is shut, remote user can invite her remote counterpart by knocking on the image of window displayed on the LCD. If her counterpart accepts invitation, he can open his window, and then they can start talking.

When the user does not wish to be viewed through the system, she can shut the curtain installed in front of the window frame. A micro switch installed at the curtain rail detects when the curtain is shut and then cut the camera off.

## IV. Evaluation

The reliability and stability of the implemented prototype system were first tested with six participants from two households including older parents and children. The system was installed at two households and used by the participants for a week. Stability of the system was monitored during the test period. After the test period, participants reported through interview sessions about system problems they noticed as well as their subjective opinions about the system usage. Based on the results of the test, the prototype system was further improved both in its software and hardware design.

Then the improved system was evaluated by two groups of participants. Each group consisted of two households, one of which was elderly parents and the other was of their children's. The system was installed at two households of a group at a time. Then the participants used the system for one week at their own paces. Quantitative data of user interaction including knocking, shutting and opening windows and curtain, looking into the screen, and voice conversation were collected during the evaluation period of one week. After the evaluation period, participants were asked to fulfill the questionnaire to probe their subjective evaluations on the system, in comparison with other communication media: postal mail, telephone, cell phone, and e-mail.

The results of subjective evaluation suggested that the proposed system was to some extent successful in offering moderate awareness of remote family members. Both older and younger participants reported that they could feel their remote family member closer with the proposed system than with other conventional communication media. Participants did not report that they perceived any violation of privacy or obtrusiveness from the system.

Fig. 2. External appearance of the implemented prototype system. A touch-screen LCD is installed inside a wooden window frame and displaying the view of the "next-door" house. Video image transmitted from the remote site is displayed inside the large window of the house.

Older participants seemed to be more comfortable with the existence of the system and the information of the remote family members conveyed by the system, while younger people seemed to pay more attentions to them.

The quantitative data of system interactions showed that the participants tended to have larger number of interactions on the first day. Although frequency of interactions then moderately decreased through the evaluation period, the participants continued to have occasional interactions with the system, such as opening windows and curtains, looking through the window frame, knocking, or having direct conversations.

## V. Discussion

The results of the evaluation study suggested that the proposed system was successful in offering the sense of connectedness with remote family members. On the other hand, the acceptance of the system in their daily life appeared to be different between generations. Older people seemed to be more comfortable with the system, while younger participants seemed to pay more attentions. One of the possible reasons might be the difference in perceptions of the value of the information conveyed by the system. Older people might be more grateful for information of their family members living far apart, while younger people might not be so. In order to clarify this issue, further comparative studies with both older and younger participants are necessary.

The participants also reported a number of system issues to be improved. The implemented system should be further improved, reflecting the reported issues, and also be tested by a larger number of evaluators. In addition, the system should also be tested by more diverse range of users, including young children, or those from different cultural backgrounds.

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