iFeel_IM: Innovative Real-Time Communication System with Rich Emotional and Haptic Channels

Dzmitry Tsetserukou
Toyohashi University of Technology
1-1 Hibarigaoka, Tempaku-cho, Toyohashi, Aichi, 441-8580 Japan
dima_teterukov@ipc.i.u-tokyo.ac.jp

Alena Neviarouskaya
University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-8656 Japan
lena@mi.ci.i.u-tokyo.ac.jp

Helmut Prendinger
National Institute of Informatics
2-1-2, Hitotsubashi, Chioda-ku, Tokyo, 101-8430 Japan
helmut@nii.ac.jp

Mitsuru Ishizuka
University of Tokyo
7-3-1 Hongo, Bunkyo-ku, Tokyo, 113-8656 Japan
ishizuka@i.u-tokyo.ac.jp

Susumu Tachi
Keio University
4-1-1 Hiyoshi, Kohoku-ku, Yokohama, 223-8526 Japan
tachi@tachilab.org

CHI 2010, April 10–15, 2010, Atlanta, Georgia, USA.
ACM 978-1-60558-930-5/10/04.

Abstract
The paper focuses on a novel system iFeel_IM! that integrates 3D virtual world, intelligent component for automatic emotion recognition from text, and innovative affective haptic interfaces providing additional nonverbal communication channels through simulation of emotional feedback and social touch. The motivation behind our work is to enrich social interaction and emotional involvement of the users of communication media. iFeel_IM! users can not only exchange messages but also emotionally and physically feel the presence of the communication partner.

Keywords
Affective haptics, affective user interfaces, online communication, haptic display, Instant Messaging.

ACM Classification Keywords
H5.3. Information interfaces and presentation (e.g., HCI): Group and organization interfaces – web-based interaction. H5.2. Information interfaces and presentation (e.g., HCI): User Interfaces – haptic I/O.

General Terms
Design.

Introduction

figure 1. User communicating through iFeel_IM!. The devices worn on the body enhance the experienced emotions.

Nowadays, companies providing media for remote online communications place a great importance on live communication and immersive technologies. Along with widely used Instant Messengers (developed by Yahoo, AOL, Microsoft, etc.), such new web services as Twitter, Google Wave gain notability and popularity worldwide. Such applications allow keeping in touch with friends in real-time over multiple networks and devices. Recently mobile communication companies launched Instant Messenger service on the cellular phones (e.g., AIM on iPhone). The popularity and appeal of 3D virtual worlds with embedded chat or instant messenger (e.g., Second Life, OpenSim) have made their ways around the globe. Such systems encourage people to establish or strengthen interpersonal relations, to share ideas, to gain new experiences, and to feel genuine emotions accompanying all adventures of virtual reality. Conventional mediated systems usually (1) support only simple textual cues like emoticons; (2) lack visual emotional signals such as facial expressions and gestures; (3) support only manual control of expressiveness of graphical representations of users (avatars); and (4) completely ignore such important channel of social communication as sense of touch.

Besides emotions conveyed through text, researchers developed an additional modality for communicating emotions in Instant Messenger (IM) through tactile interfaces with vibration patterns [4]. However, in the proposed method users have to memorize the vibration or pin matrix patterns and cognitively interpret the communicated emotional state. Demodulation of haptically coded emotion is not natural for human-human communication, and direct evocation of emotion cannot be achieved in such kind of systems.

Driven by the motivation to enhance social interactivity and emotionally immersive experience of a real-time messaging, we pioneered in the idea of reinforcing (intensifying) own feelings and reproducing (simulating) the emotions felt by the partner through specially designed system, iFeel_IM! (Figure 1). The philosophy behind the iFeel_IM! (**i**ntelligent system for **Feel**ing enhancement powered by affect sensitive **I**nstant **M**essenger) is "***I feel*** [therefore] ***I am!***". The emotion elicited by physical stimulation might imbue our communication with passion and increase the emotional intimacy, ability to be close, loving, and vulnerable. The interpersonal relationships and the ability to express empathy grow strongly when people become emotionally closer through disclosing thoughts, feelings, and emotions for the sake of understanding.

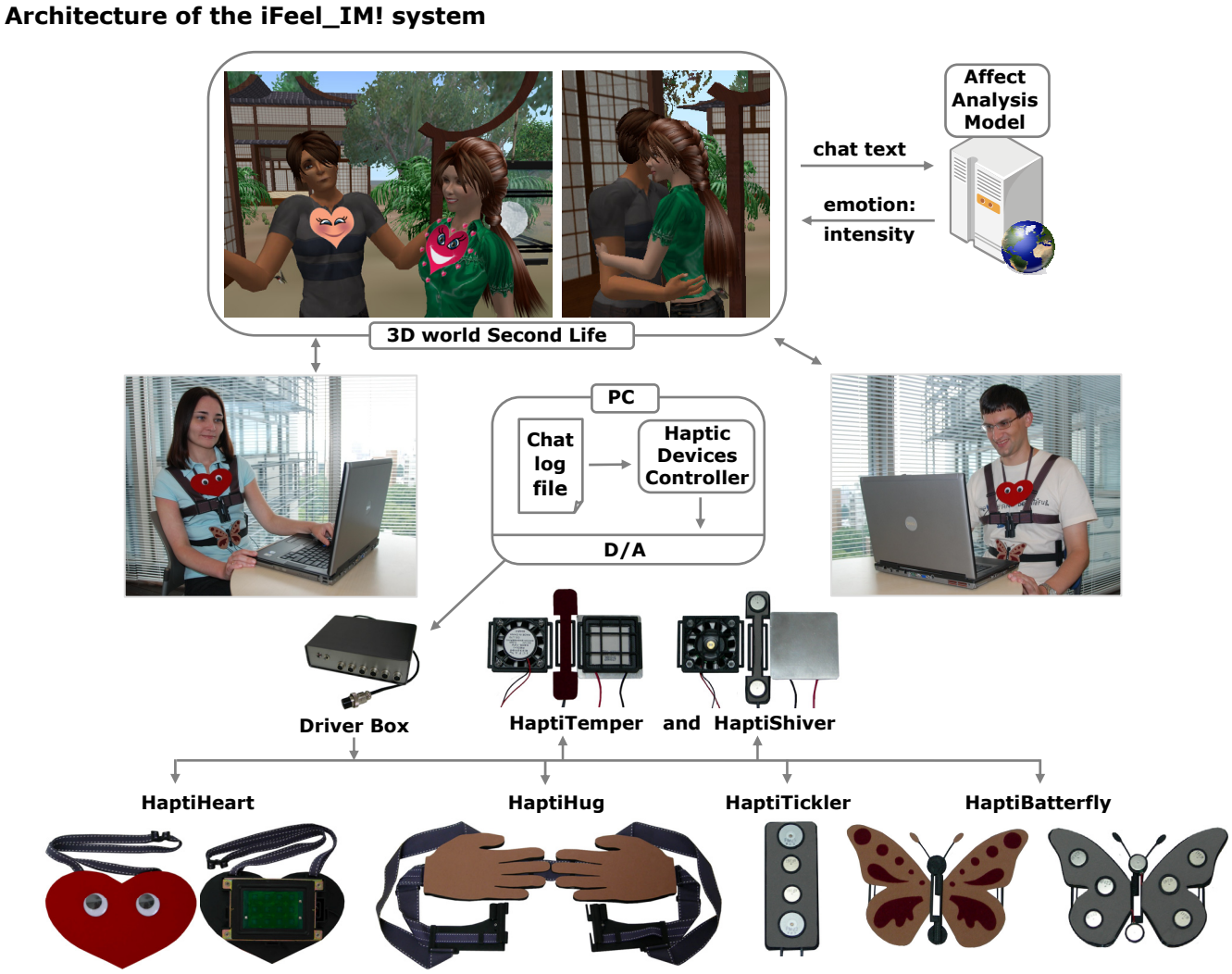

figure 2. Architecture of the iFeel_IM! system. In order to communicate through iFeel_IM!, users have to wear innovative affective haptic devices (HaptiHeart, HaptiHug, HaptiButterfly, HaptiTickler, HaptiTemper, and HaptiShiver) developed by us.

In the iFeel_IM! system (Figure 2), great importance is placed on the automatic sensing of emotions conveyed through textual messages in 3D virtual world Second Life, the visualization of the detected emotions by avatars in virtual environment, enhancement of user's affective state, and reproduction of feeling of social touch by means of haptic stimulation in a real world. As a media for communication, we employ Second Life, which allows users to flexibly create their online identities and to play various animations of avatars.

The control of the conversation is implemented through the Second Life object called EmoHeart attached to the avatar's chest. Once attached to the avatar, EmoHeart object (1) listens to each message of its owner, (2) sends it to the web-based interface of the Affect Analysis Model (AAM) [5] located on the server, (3) receives the result (dominant emotion and intensity), and visually reflects the sensed affective state through the animation of avatar's facial expression, EmoHeart texture (indicating the type of emotion), and size of the texture (indicating the strength of emotion).

In addition to communication with Affect Analysis Model, EmoHeart is responsible for sensing symbolic cues or keywords of 'hug' communicative function conveyed by text, and for visualization (triggering related animation) of 'hugging' in Second Life. The results from the Affect Analysis Model and EmoHeart are stored along with the chat messages in a file on local computer of each user. Haptic Devices Controller analyses these data in a real time and generates control signals for Digital/Analog converter (D/A), which then feeds Driver Box for haptic devices with control cues. Based on the transmitted signal, the corresponding haptic device worn by user is activated.

Affective Haptic Devices

In order to support the affective communication, we implemented several novel haptic displays embedded in iFeel_IM!. They make up three groups. First group is intended for emotion elicitation implicitly (HaptiHeart, HaptiButterfly, HaptiTemper, and HaptiShiver), second type evokes affect in a direct way (HaptiTickler), and third one uses sense of social touch (HaptiHug) for influencing on the mood and providing the sense of physical co-presence.

HaptiHug: Realistic Hugging Over Distance

On-line interactions rely on senses of vision and hearing, and there is a substantial need in mediated social touch [2,3]. When people are hugging, they generate pressure on the chest area and on the back of each other by the hands, simultaneously. The key feature of the developed HaptiHug device is that it physically reproduces the hug pattern similar to that of human-human interaction. The couple of oppositely rotating motors are incorporated into the holder placed on the user's chest area. The Soft Hands, which are aligned horizontally, contact back of the user. Once 'hug' command is received, couple of motors tense the belt, pressing thus Soft Hands and chest part of the HaptiHug in the direction of human body (Figure 3).

The duration and intensity of the hug are controlled by the software in accordance with the emoticon or a keyword, detected from text. For the presentation of a plain hug level (e.g., '(>^_^)>', '{}', '<h>'), a big hug level (e.g., '>:D<', '{{}}'), and a great big hug level (e.g., 'gbh', '{{{}}}'), the different levels of pressure with different durations are applied on the user's back and chest.

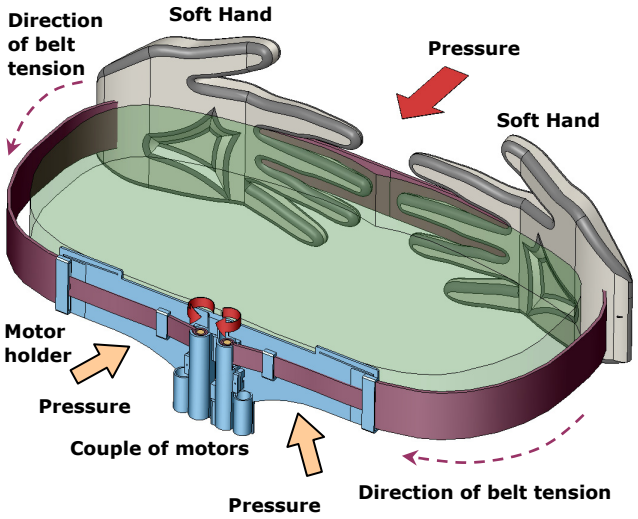

figure 3. Structure of the wearable HaptiHug device.

The significance of our idea to realistically reproduce hugging is in integration of active-haptic device HaptiHug and social pseudo-haptic touch simulated by hugging animation (Figure 4). Thus, high immersion into the physical contact of partners while hugging is achieved.

HaptiHeart Enhancing Our Emotions

Each emotion is characterized by a specific pattern of physiological changes. We selected four distinct emotions having strong physical features: 'anger', 'fear', 'sadness', and 'joy'.

The ability of false heart rate feedback to change our emotional state was reported in [1]. We developed heart imitator HaptiHeart to produce special heartbeat patterns according to the emotion to be conveyed or

figure 4. Snapshots of hugging animation in Second Life.

elicited (sadness is associated with slightly intense heartbeat, anger with quick and violent heartbeat, fear with intense heart rate).

The HaptiHeart consists of two modules: flat speaker FPS 0304 and speaker holder (Figure 5). The flat speaker sizes (66.5 x 107 x 8 mm) and rated input power of 10 W allowed us to design powerful and relatively compact device. It is able to produce realistic heartbeating sensation with high fidelity.

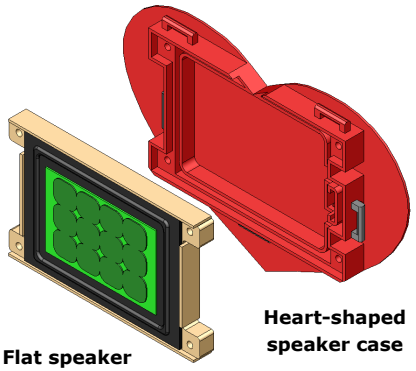

figure 5. Layout of the HaptiHeart haptic display.

The pre-recorded sound signal with low frequency generates the pressure on the human chest.

Butterflies in the Stomach and Shivers on the Spine

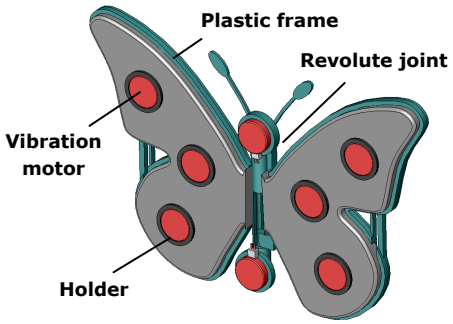

figure 6. Structure of the HaptiButterfly.

HaptiButterfly is responsible for the evocation of joy emotion (Figure 6). The idea behind this device is to reproduce effect of "*Butterflies in the stomach*" (fluttery or tickling feeling in the stomach felt by people experiencing love) by means of the arrays of vibration motors attached to the abdomen area of a person.

In order to boost fear emotion physically, we designed HaptiShiver (see Figure 2) interface that sends "*Shivers down/up human body's spine*" by means of a row of vibration motors (HaptiShiver), and "*Chills down/up human body's spine*" through both cold airflow from DC fan and cold side of Peltier element (HaptiTemper). HaptiTemper is also intended for simulation of warmth to evoke either pleasant feeling or aggression.

We developed HaptiTickler with the purpose to evoke positive affect (joy emotion) in a direct way by tickling the ribs of the user. The uniqueness of our approach is in (1) combination of the unpredictability and uncontrollability of the tickling sensation through random activation of vibration motors, (2) high involvement of the social and emotional factors.

Conclusions

While developing the iFeel_IM! system, we attempted to bridge the gap between mediated and face-to-face communications by enabling and enriching the spectrum of senses such as vision and touch along with cognition and inner personal state. In the paper we described the architecture of the iFeel_IM! and the development of the novel haptic devices. User of iFeel_IM! can perceive the intensive emotions during online communication, use desirable type of stimuli, comfortably wear and easily detach devices from torso.

References

[1] Decaria, M.D., Proctor, S., and Malloy, T.E. The effect of false heart rate feedback on self reports of anxiety and on actual heart rate. *Behavior research & Therapy*, 12 (1974), 251-253.

[2] DiSalvo, C., Gemperle, F., Forlizzi, J., and Montgomery, E. The Hug: an exploration of robotic form for intimate communication. In *Proc. RO-MAN 2003*, IEEE Press (2003), 403-408.

[3] Haans, A., and Ijsselsteijn, W. I. Mediated social touch: a review of current research and future directions. *Virtual Reality*, 9 (2006), 149-159.

[4] Rovers, A.F., and Van Essen H.A. HIM: a framework for haptic Instant Messaging. *Ext. Abstracts CHI 2004*, ACM Press (2004), 1313-1316.

[5] Neviarouskaya, A., Prendinger, H., and Ishizuka, M. Compositionality principle in recognition of fine-grained emotions from text. In *Proc. ICWSM* 2009, AAAI Press (2009), 278-281.