# CALLY: The Cell-phone Robot with Affective Expressions

Ji-Dong Yim, Christopher D. Shaw
School of Interactive Arts and Technology
Simon Fraser University
250 - 13450 – 102nd Avenue, Surrey
B.C. Canada
jdyim@sfu.ca, shaw@sfu.ca

## ABSTRACT
This poster describes a robot cell-phone named CALLY with which we are exploring the roles of facial and gestural expressions of robotic products in the human computer interaction. We discuss non-verbal anthropomorphic affect features as media for building emotional relationships between a user and a product, and introduce new types of robotic products in the market that may be capable of establish intimacy by applying such features. A couple of social robot application ideas generated from the early phase of our project are also presented with their usage scenarios and implementations. CALLY was used in our initial participatory design workshop and helped participants generate new application ideas.

## Categories and Subject Descriptors
H.5.2 [**Information interfaces and presentation (e.g., HCI)**]: User Interface

## General Terms
Design, Human Factors

## Keywords
Robot, mobile phone, non-verbal anthropomorphic affect features

## 1. INTRODUCTION
What if an alarm clock not only rings but also moves around and hides from the owner? What if a car navigation system leads its owner to the destination by pointing directions with its gesture when he/she is driving? What if a telephone enriches conversation by physically mimicking the remote user's expressions?

Besides verbal languages, people use many kinds of interaction media such as tones of voice, facial expressions and gestures. In human-machine interaction, however, there is a lack of means for communication. Researchers have suggested a variety of physical computing devices providing more intuitive modalities to enrich the HCI, and it is now common for the real world product designers as well to consider new sensors and haptic components when they design convergent information artifacts. But, in terms of output media, not many products support dynamic feed-back beyond 2D displays, speakers and vibrating motors. This lack of modality may not cause usability problems directly; instead, it brings dry conversations between a user and his/her possessions, and it is very hard to establish an emotional sympathy from that kind of boring relationship. For example, while lots of on-screen/hardware skins and toy applications have been designed to be customized in mobile devices, most of them do not seem so successful at building long-term intimacy since they only stay inside or on the thin surface of existing products.

The Softbank Mobile Corp. and Toshiba recently launched an interesting mobile phone having legs and arms [1]. It looks very similar to an application of our project, but of which limbs are just static decorations. A car accessory, the Thanks Tail, showed a way in which an everyday product can convey emotional expression, but lacks autonomous response [2]. Examples of more sophisticated robotic applications can be seen in pet robots such as AIBO and Paro. It now seems the development strategy is shifting in the market; recent robotic products such as Rolly (by Sony), Miuro (by ZMP) and Nabaztag (by Violet) are focused on music, entertainment and networked multi-user environments. This new generation of products has simple perception abilities and abstract- or non-mobility. And, more importantly, they are based on the existing products rather than created as a whole new robot agent.

This research is focused on non-verbal and anthropomorphic affect features like facial expressions and physical behaviors that a social robotic product can employ. The main approach of our research is based on user-centered design which is accomplished with a broad range of interdisciplinary studies relating human perception, information design, artificial behaviors, emotional communication and so forth. In this poster, however, we describe a couple of robot application scenarios based on cell-phone usage context, implementations of the robots named CALLY and, while initial, a pilot participatory design workshop to generate further design ideas.

## 2. CALLY
One of the target platforms we considered in our brainstorming sessions is mobile phones. As a cell-phone has more computing power and supports more complex tasks, it has become more familiar device in our life. A conventional cell-phone user may use his/her device mainly in telephone call and also often look at it to check some information like time, date, missed calls and battery status. Now it is common with a cell-phone that a user wakes up from sleep with alarm sound, exchanges text messages, takes pictures and listens to the music.


*HRI'09*, March 11–13, 2009, La Jolla, California, USA.
ACM 978-1-60558-404-1/09/03.

We initially developed several cell-phone usage scenarios in which robot behaviors can enrich user-product interactions. We picked the alarm ring situation as the first target context, because it has a balanced complexity in perceptional abilities, intrinsic gestural instructions, a motor system and intelligent responses. The second scenario we picked is based on multi-user situation. We imagine a tele-conference or mobile-network where two or more people are connected via cell-phone robots. Each participant can spread an instant emotion cue to control the facial expressions and gestures of others' agents.

## 2.1 Robot implementation

The proposed cell-phone robot consist of two parts; hardware and software application [Figure 1]. They can create a network and communicate each other via a wireless protocol the cell-phone devices support.

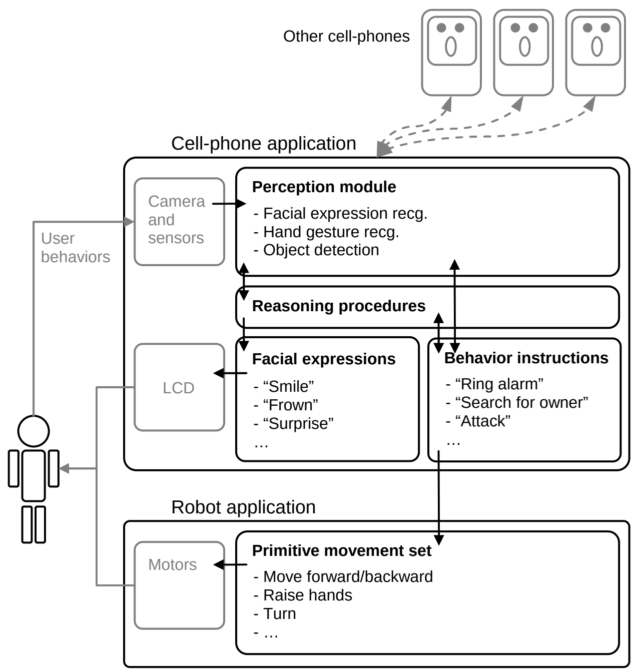


**Figure 1. Implementation architecture of the proposed cell-phone robot application**

### *2.1.1 Hardware*

The robot body was designed based on the minimum requirements of mobility and gesture variations in the given alarm scenarios. It was implemented by using a robot toolkit, Bioloid Expert Kit [3]. It has four wheels, two arms, a cell-phone dock and a battery/controller pack [Figure 2]. The wheels, of which rotations are separately controlled, provide the robot with mobility enabling the body to move forward, backward, right- or left-turn. Each of the arms has two degrees of freedom; up-and-down and grab-and-release. The upper body can rotate +/-150 degrees. The cell-phone dock is located in the upper body right in front of the battery pack, so the cell-phone acts like a robot head and displays facial expressions on its LCD.

### *2.1.2 Behavior, perception and reasoning*

The behavior instructions include a primitive movement set, a task list, and a sequence of the task flow. The primitive

**Figure 2. The first prototype: CALLY**

movements, very small and low level elements of the robot gesture, e.g. 'move forward/backward', 'turn right/left', are defined and stored in the micro-controller of a robot. Each of higher level tasks consists of primitive movements and percepts. For example, the task 'search for the owner' is accomplished with 'repeat', 'turn right in a certain angle' and 'detect a face'. The perception module was designed to capture video inputs from a camera, to recognize human features, to extract gestures and to trigger event procedures in the robot's behavior instructions. Those behaviors and perception signals can be simulated from a server PC.

### *2.1.3 Networking*

Technically, there are three different wireless networks employed in the prototype; the Bluetooth for communicating between cell-phone and the robot, the Wi-fi for multiple cell-phones, and a customized wireless protocol for PC-robot communication. The Wi-fi networking has a typical server-client structure so enables us to simulate the multi-user conferencing scenario. At the pilot participatory design workshop, the Wizard of OZ method was used which is performed via the PC-robot protocol.

## 3. CONCLUSION

We introduced the early results of our on-going project exploring affect features of social robotic products. An interesting lesson from our pilot participatory design workshop is that CALLY enabled the participants to more actively take part in generating new ideas. After a single demo, they could set about imagining suitable situations for this new product, explain its behaviors by mimicking the robot's gesture, and, from that, figure out hidden advantages and limitations by themselves. The design session lasted twice longer than its schedule by the participants' request.


## 4. ACKNOWLEDGMENTS

This work is supported in part by Nokia under a Nokia University Program and by the Korea Institute of Design Promotion under a Government Grant for Future Designers.


## 5. REFERENCES


[1] Toshiba, 815T PB mobile phone, http://www.toshiba.com/

[2] Kazuhiko Hachiya, Thanks Tail

[3] Robotis Co., Ltd. Bioloid. http://www.robotis.com/