Gemini: a Handbag for Pervasive Social Communications

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Abstract— **Fashionable technology is becoming a trend in HCI design. It extends the traditional understanding of HCI by emphasizing on the aesthetic element. Pervasive social communications are instant social activities through communications based on mobile elements. This paper investigates how to use the fashionable technology in pervasive social communications. It presents the design and preliminary prototype of Gemini, a fashionable bag for pervasive social communications. The social acceptance of Gemini design is also explored through a small-scale user study.**

Keywords-trust; identity, fashionable technology, wearable computing, human-computer interation

I. INTRODUCTION

Nowadays, aesthetics is becoming a key factor for making a purchase decision. It is almost the same importance as battery life when people decide to purchase a mobile phone. Fashion has become a social element to impress and attract people. Fashion industries are making efforts to combine fashion and high technologies.

Fashionable technology, by definition, refers to the intersection of design, fashion, science and technology [1]. It is beyond the simple combination of the above areas, but rather the focus is integrating aesthetics and fashionables into functional technologies. As one part of fashionable technology, fashionable wearable represents the fashionable technology by using garments, accessories or jewelries.

On the other hand, social communications tend to be pervasive. One major device for pervasive social communications is mobile phone. As communications based on mobile phones have been developed to fairly good extent, people are seeking for fashionable communication ways instead of functions. One attractive way is to extend some functions of mobile phones to be embedded into other wearable devices. In this paper, we design Gemini, a fashionable handbag that is applied for pervasive social communications, assisted by mobile phones.

The name "Gemini" originates in astrology, which refers to the third sign of zodiac [2], but with the support of another person taken inside. In analogy, Gemini system offers users a fashionable way for pervasive social communications by using a handbag, with the support of a mobile phone. Gemini looks like a normal handbag, but decorated with LED lights, the status of which are controlled by a Gemini app that runs on a mobile phone. The fashionable and pervasive feature of Gemini extends the scope of mobile social communications.

The rest of the paper is organized as below. Section 2 briefly reviews related work in the field of fashionable and wearable technology. Section 3 presents the design of Gemini. This is followed by the main functions of Gemini handbag illustrated in Section 4. In Section 5, we explore the acceptance of Gemini through a small-scale user study. Finally, conclusion and future work are presented in the last section.

II. RELATED WORK

Wearable computing designs equipments and devices wearable by humans. The most common wearable items include clothes, shoes, bracelets, and so on. One major problem of the prevalence of wearable computing is its social acceptance. Some wearable designs mainly consider functionalities. This made some sophisticated wearable products look like a robot, difficult or inconvenient to wear in daily life. Most of them still remain in the stage of prototypes. Fashionable technologies go beyond wearable computing by emphasizing aesthetics.
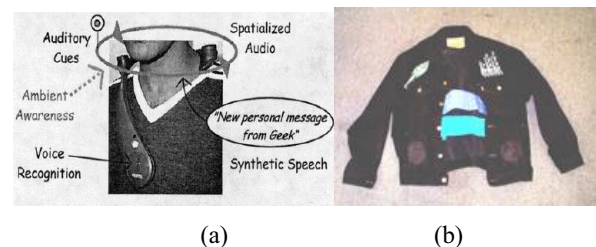

Figure 1. Early wearable prototypes: (a) Romandic radio (*adapted from* [3]), (b) Music Jacket (*adapted from* [4])

MIT Media Lab is among early research institutes engaged in fashionable technologies. Romandic radio [3] and Music Jacket [4] were their early prototypes. Romandic Radio is a neck set that aims to mine ambient contextual information and send to users as notification. It gathers the ambient sound through microphones on the neck set and notifies users via audio messaging or tactile feedback on the body (see Figure 1 (a)). Music Jacket aims to extend musical environment. It combines a normal Levi jean jacket with a fabric keyboard and a midi signal generator to produce a sound and applies speakers

to amplify the sound. All the add-ons are embroidered inside the jacket (see Figure 1 (b)).

Jacket has become a popular platform for developing fashionable technology due to its daily-use nature. Smart Jacket [5] is designed to control body temperature, enhance night visibility and monitor activity level. For example, some parts of the jacket glow in the evening to warn safety (see Figure 2 (a)). Love Jackets [6] are a pair of jackets designed for social awareness. Once the pair finds each other, in at least 3-meter distance, facing each other, the two jackets beep and blink (see Picture 2 (b)).

(a)   (b)

Figure 2. Wearable jacket prototypes. (a) Smart Jacket (*adapted from* [5]) and (b) Love Jackets (*adapted from* [6])

Women consider dresses as one symbol of femininity. There has a deep connection between dresses and fashion. Firefly Dress [4] and necklace uses conductive fabric to distribute power throughout the dress. The dress was attached with small lights, i.e., LEDs. When the wearer moves, the LEDs brush lightly against the fabrics power, creating a dynamic lightening effect (shown in Figure 3 (a)). A more recent artifact is the Microsoft Printing Dress [7]. The printing dress enables wearer to enter their thoughts onto the fabric and wear them as a form of art displayed to the public, shown in Figure 3 (b). It is one of the pioneer works that integrates fashionable technology with social networks.
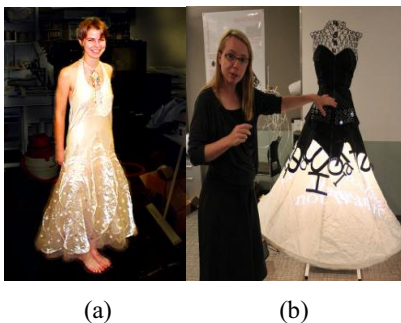

(a)   (b)

Figure 3. Wearable dresses. (a) Firefly Dress (*adapted from* [4]) and (b) Microsoft Printing dress (*adapted from* [7])

In addition to social media, sharing widely exists in physical world. Car sharing is one of the examples. Instead of posting the sharing information online or via mobile phones, car manufactures design sharing information on car itself. EDAG has exhibited 'Light Car Sharing' in the 2012 International Geneva Motor Show. The car is surrounded by displays outside its body. They serve as ambient displays for public information such as availability of carpooling (see Figure 4).

Figure 4. EDAG 'Light Car' at Geneva Motor Show 2012 [8]

Bags are among the top consumed fashionable accessories. It is thus natural to design technology-enhanced fashionable bags. Courtly bag [8] is a fashionable bag containing lights and sounds that can shine in dark and transmit information. LadyBag [9] is designed as a notification of missing items in the bag. All items in the bags, e.g., keys, phones are attached with RFID tag. Therefore, the bag keeps log of items in the bag. It shows the icons of items that are missing on the LED display of the bag. SEIL bag is a handbag using LED display and flexible printed circuit board for safe bicycle riding, shown in Figure 5 (b). It displays important information such as turning and braking to travelers behind (see Figure 6).
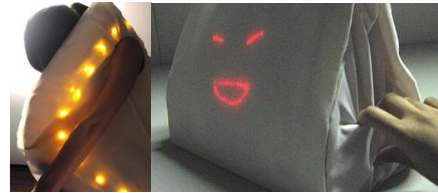

Figure 5. Wearable handbags. (a) Courtly bag (2008, *adapted from* [8]), (b) LadyBag (2008, *adapted from* [9])

Figure 6. SEIL bag (2010, *adapted from* [10])

The work mentioned above shed light on a novel means and materials for fashionable technology. However, they have not investigated the social acceptance issues, e.g. whether this kind of design is considered as fashionable or wired. None existing work applies fashionable technology for the purpose of pervasive social communications. Furthermore, they are standalone accessories for communications and could be expensive. Gemini, on the other hand uses handbag as a form of fashion and applies LEDs as decoration and a communication carrier. Its design takes into account various practical issues, such as the appearance, prices and technical implementation. We aim to design a new way of fashionable communications for pervasive social networking that is acceptable in terms of aesthetics, prices and functions.

III. GEMINI SYSTEM DESIGN

Nowadays, a mobile phone has become a practical device for pervasive computing, networking, communications and entertainment. Its small, portable and pervasive feature makes it a necessity to be in handbags. This fact motivates us to design a fashionable technology that combines both the mobile phone and a fashionable handbag together. Gemini targets on a handbag used mainly by females. It can be also flexibly applied into the design of other types of bags, such as school bags [10].

When designing a Gemini bag, we take into account both appearance and price issues. Gemini system consists of two parts: Gemini Bag and Gemini App. There are two ways of information display: the information displayed on the Gemini Bag to the public and the information displayed to the user in the Gemini App, a mobile application to control the display of Gemini Bag.

Gemini Bag is a fashionable bag embroidered with an LED panel with an array of 12*20 LED lights, as shown in Figure 7. The colors of the LEDs can be customized upon need. In the current version, all lights are one-colored, i.e., red. Each light has two states: on or off. When all lights are off, the LED panel serves as a natural decoration to the bag. When a certain signal is sent to the LED panel, the array can display meaningful information on the bag, serving as a blinking, shining and unique component of the bag.

The handbag has no difference from any normal ones in order to make the appearance more acceptable. We use arrays of LED in order to control the price of Gemini. This is one of the cheapest ways to display information.

Figure 7. Gemini Bag design with LED distribution array

Gemini App is a private sketch board for the user to plan what is shown on the bag. It also serves as a remote controller of Gemini Bag. The Gemini App emulates the LED distribution of Gemini Bag. It contains 12*20 dots (as shown in Figure 8). The user can plan the sketching by drawing on the surface of touch screen. Once the user confirms his/her drawing, the App sends the signal of the drawing to the bag, which displays the exact lights as drawn on the phone.

Gemini Bag and Gemini App communicate via Bluetooth or other local connection ways. Each bag has a private key. The App needs the key in order to pair up with the bag. This design ensures the security of the Gemini system. Therefore, only an authorized user can control the display of the Gemini Bag.

Once successfully paired up, the App sends a 240-bit string to the processor of the bag. Such bits are in the form of '1100000101 ….. 001', indicating the status of each LED light, i.e., on or off.

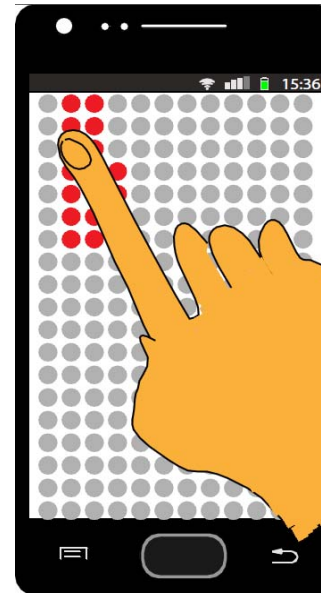
Figure 8. An example of Gemini App user interface with touch interaction and identical LED array with Gemini Bag

IV. USAGE AND SCENARIOS

One major attraction of Gemini Bag is that it stands out from others. For example, flashing lights make the bag different from other items; personalized text and unique form of displaying make the content more eye-catching than other forms of content; novel design and decoration make its users stand out from others. Gemini can offer a wide range of functions. We mainly discuss three of them, namely identification, communication and self-presentation.

A. Identification

One of the major functions of Gemini Bag is to show the identity of the user. Users can type the name or their message on the bag, which will blink and shine. This function is secured because the Gemini app could only pair with the bag having the security key. Identifying a bag becomes a unique way for users to find the bag owner.

Scenario 1: Alice enjoys hanging around in the evening with friends. However, it is relatively difficult to identify each other in the dark. With Gemini, Alice sends the text 'here' and people can find her easily in the evening. The interface of Gemini bag in this scenario is shown in Figure 9.

Figure 9. Examples of using Gemini bag for identification

B. Communications

Gemini Bag can be applied as a public display. In other words, it displays what its owner wants to express publicly on the bag. Users are therefore able to communicate with each other through their bags, even though they are strangers. The following scenario illustrates how Gemini is used for communications or recognition.

Scenario 2: Alice is visiting New York for a business trip. Bob, as a local agent in New York, is responsible for picking up Alice at the airport and arranging her trip. They have not met each other before. In order to make it easier for Bob to recognize her at the airport, Alice types 'Alice' on Gemini app on her phone. The letters are now shining on her Gemini Bag. Bob quickly find her among hundreds of passengers, as is shown in Figure 10.

Figure 10. Examples of using Gemini Bag for recognition

C. Self-presentation

Self-presentation is an approach in which people try to influence the perception of their appearance. People use various ways to manage their impressions, particularly for those who are in seek of fashion. We mentioned earlier that sometimes whether an item impresses others outweighs its functions. Gemini provides a way for impressive self-presentation due to at least two reasons. First, the bag is decorated with shining visuals. Second, users are able to customize the displayed visuals, e.g., text or drawings. The following scenario illustrates how Gemini can be used for the purpose of self-presentation.

Scenario 3.1: Alice is spending her third day in New York. She uses Gemini to display her emotions in real time. She feels excited when she saw the skyscrapers, and she displays 'exciting' on her bag (Figure 11 (a)); she is happy with the nice weather here, and she makes a shining 'happy' on her bag (Figure 11 (b)); she is angry when she received some annoying request from her clients, and she changed the emoticon to 'angry' on her bag (Figure 11 (c)); the last day, she feels sad to leave, which is shown on her bag (Figure 11 (d)). Figure 12 shows the screenshots of how user draws a smiling face on the Gemini app.
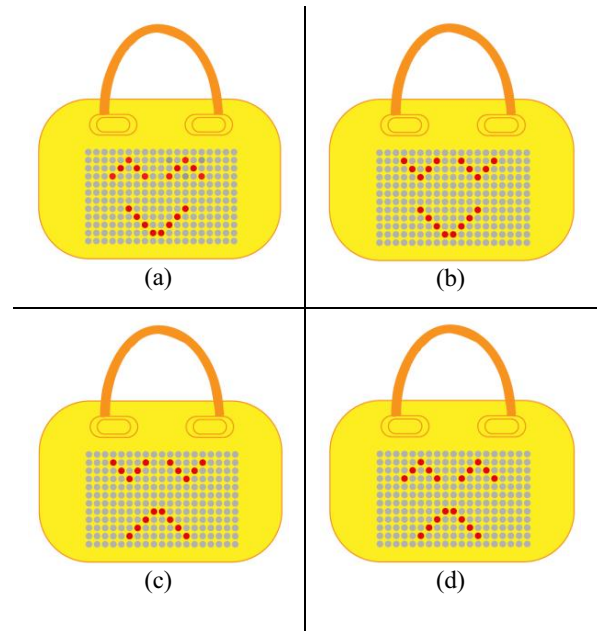

| (a) | (b) |
| (c) | (d) |

Figure 11. Examples of using Gemini bag for self-presentation, in the case of displaying real-time mood, i.e., (a) exciting; (b) happy; (c) angry; (d) sad.
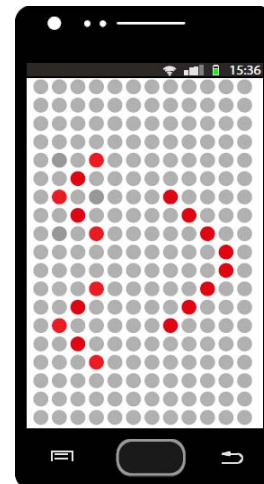

Figure 12. Screenshots of drawming a smiling face on Gemini App

Scenario 3.2: When Alice comes back from her trip in New York, she is still in love with the city. In order to show that she is back from the trip and her impression about the city, she changed her Gemini profile to '(love) NY', as shown in Figure 13.

Figure 13. Examples of using Gemini bag for self-presentation, in the case of displaying text and expressing emotion

V. PILOT STUDY

We performed a small-scale user study on the social acceptance of Gemini. We showed the low fidelity prototypes to four female participants. Even though the study is within a small scale, we choose from different demographics, including age and professions. Two of them are university students (20-25 years old), one is working as an engineer (30-35 years old) and the other is a manager in a hotel (35-40 years old).

We showed them the interface and interaction techniques of the bag. We then asked them to provide their feedback on whether they would like to use Gemini if it is available. We also encouraged them to propose other possibilities that they would like to use Gemini.

Some comments of these four participants are presented below.

"I simply feel it is very cool to wear such things around campus. It is not easy for me to tell the exact reason. But I am pretty sure if I had such a shining bag, it would be really eye-catching. I can simply doodling something on my mobile phone, and it goes to my bag. Cool, isn't it? It is something like tweeting in real life. The only difference is that it is tweeting to the public in real world, in contrast with publish information in the online public world." (Student, 22 years old)

"If I had such interesting bag, I would most probably use it for calling friends to an event. For instance, I would frequently go to sports, such as swimming or dancing. I was always searching friends to go with me together. However, sometimes it is not convenient to ask. One possible solution is to post them on Facebook. If we consider the bag as a kind of bulletin board, we could simply post some symbols of events on the bag.

Friends will get the idea what I would like to do today, e.g., going to tennis." (Student, 25 years old)

"It is just interesting! I am really a big fan of fashion bags. There is a saying that there is always a bag missing from a women's closet, and this is THE bag I am missing. If you have a look at my bags, you find that I always try to find some shining bags, either by decoration or by material. This intelligent decoration is unique and new. I can change the shining decoration every day based on my mood. It makes me feel that I have a DIY (Do It Yourself) bag. Cool, isn't it?" (Engineer, 33 years old)

"The first thing came to my mind is that we could potentially use it for advertisement. It is a free, natural and green way of advertising, isn't it? I am also thinking if I do not need to input information manually, we could have information displayed there automatically. Think about a fashionable bag that displays floating stock information in real time. That would be even more eye-catching. People will first notice your bag, then the stock market, and eventually you will become the focus." (Hotel manager, 38 years old)

From the interview with different segment of users, we found that young female students are usually the fashion seekers and eager to express and share. They are fun seekers and are very interested in eye-catching product. Therefore they are very interested in such a bag. Elder women also like the idea and design. They like the product mainly because it is convenient to show some information to other people, without showing their phone to others. It is a way to keep their privacy by sharing limited information. They also mentioned using the bag for advertising purpose. In general, we could see various functions by combining fashionable bag and information visualization.

VI. CONCLUSION AND FUTURE WORK

We designed Gemini -- a fashionable handbag for pervasive social communications, assisted by a mobile application. The main goal of the design is to investigate the applicability and social acceptance of combining and extending the concept of pervasive computing from mobile phone to wearable devices. We present three usage scenarios that Gemini can offer, namely identification, communications and self-presentation. One common thing in the above functions is that Gemini makes things stand out. It makes the bag stands out, the information on the bag stands out and its users stand out. The 'standing out from others' feature of Gemini is identical with the purpose of fashionable technology. The design considered practical issues of Gemini. The estimated price of the bag depends on the price of a normal bag and an array of LEDs. We also carried out a small-scale pilot study to investigate social acceptance of Gemini. The preliminary study indicates that users were highly encouraged and excited about Gemini and they would use it for various reasons, such as decoration, eye-catching, self-presenting, and advertising. The usage scenarios provided by users further extends our early understanding on Gemini.

Gemini is a proof-of-concept to demonstrate the implementability and social acceptance of the novel interface and product. For future work, we will carry out larger-scale

user studies to investigate user need in order to improve the current design. Notably, the initial design of Gemini mainly targets at female users. The design idea and technology of Gemini for male users are the same, except that different styles of bags could be applied. We will explore new usage scenarios for Gemini and further evaluate it with various users.

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