# LightingHair: Situated Personal Wearable Fashion Interaction System

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## Abstract

**LightingHair** (LH) is a lighting interactive system towards personal fashion based on wearable technology. This paper mainly discuss how light media emerges in our daily fashion life and the new possibilities brought with interaction and intelligence. 3 scenarios of ambient awareness, arousal awareness and social interaction were explored how environment and interactions can provide aesthetic support in personal headwear.

## Author Keywords

Interactive aesthetic; wearable media; intelligent lighting; entertainment

## ACM Classification Keywords

H.5.2 User Interfaces: Interaction styles (e.g., commands, menus, forms, direct manipulation)

## Introduction

Across different countries and cultures, hair decoration plays a great role in embellishing human beings, not only for beauty, but also for social status indication and religious practices. As the evolution of history and technology, different kinds of material have been taken used to decorate people's hair and outlook. We believe that bringing digital and intelligence elements into personal hair decoration can fresh not only the

aesthetic expression of our identity and behavior, but also enrich the functions of hair decoration.

**LH** is a lighting interactive system towards personal fashion based on wearable technology. It mainly discusses how light media emerges in our daily fashion life and the new possibilities brought with interaction and intelligence. Based on a LED O/I system, different light texture and color were carried out and discussed.

### Related Work

LED Light is a flexible media used in digital art, and information display. Through coding and designing, it metaphorically conveys information like human movement, emotions and attitudes with its aesthetic features, such as light intensity, dynamic and colors. Being related to our work, Gravity of Light [1], a LED hat has been designed to mimic the fuild with gravity according to human movement. And Situated Apparel[2], a wearable LED display system, has been designed to display dynamic information during the outdoor sport and situated communication. Many researches and explorations have been done to analyze sociable and emotional communication within public space scenarios, such as Chit Chat Club [3] and Telemurals [4]. Dunne[5] explore areas of significant potential for the development of smart clothing, and identify the design barriers to achieving commercialization of these applications in four major areas: functionality, manufacture, developmental practice, and consumer acceptance. Vega et al. [6] explored body's surface as an interactive platform by integrating technology into beauty products applied directly to one's skin, fingernails and hair.

Based on prior studies and social psychology theory, the emotional identity and resonance can be stimulated by cross-infection and interoperability obtained in communication scenarios.

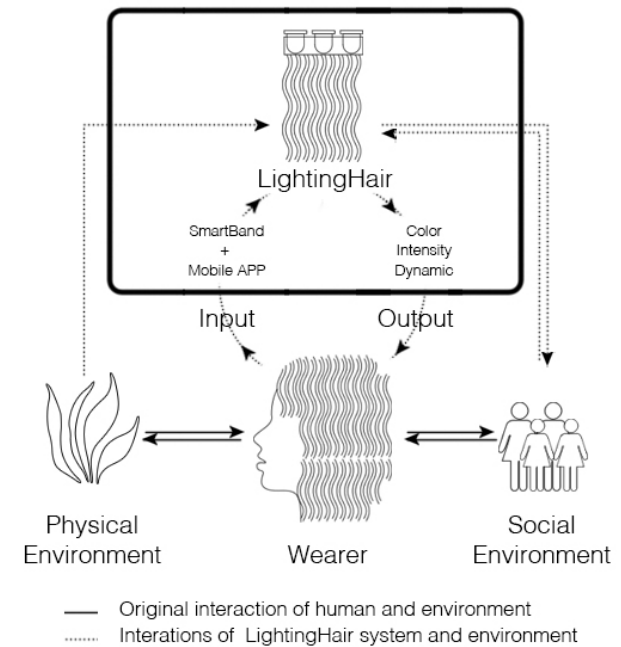## Hardware Framework and complementation
*LH* framework



**Figure 1.** Interaction framework of **LH**

**Figure 1** shows the frameworks of hair decoration and environment. Originally, physical situation, social environment and personal preference are essential keys to people's outlook and hair style. **LH** amplifies the interactions between hair decoration and wearer, external environment through visualization and behavior interaction. The **LH** system consist of two data inputs (the monitoring data from sensors and the data manually entered from mobile terminal), **HairSlice** with full-color LED for output, ardiuno for computational processing, and Bluetooth for data transport.
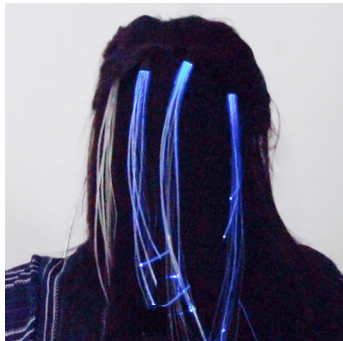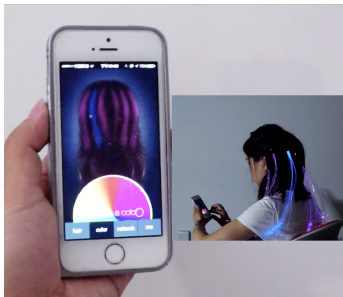
**Figure 3.** Wearing LightingHair without restyle
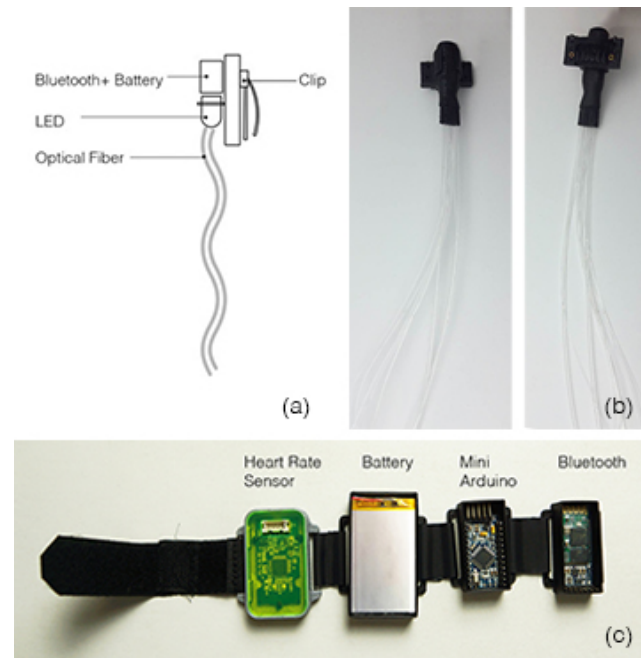


**Figure 4.** Scenario 1 of Lighting Control



**Figure 2.** (a) Constructure of **HairSlice** (b) Image of **HairSlice** Unit (c) Compositions of **SmartBand**

**HairSlice**: Taking use of optical fiber, it mimics the shape of hair to perform a good visual fusion. Both body-glowing and end-glowing optical fibers are used in hair slice. The user can feel the light from the fibers' ends and halo without looking directly at light. For other people around, the gorgeous e-fashion is not glaring light pollution. Each hair slice unit can be attached to wearer's hair with a clip. Full-color LED can display static or dynamic lights with different colors. Figure 2 (a) and (b) shows the constructure of hair slice. It can communicate with **SmartBand** and mobile APP through Bluetooth, and display different colors with LED.

**SmartBand**: Consisted of mini Arduino, Bluetooth, heart rate sensor, photosensor and battery, it can detect human movement and heart rate, and communicate with the hair slice units (Figure 2(b)).

## Wear and Control

For traditional hair decoration, people comb and fix hair with accessories, and observe the appearance with a mirror. For **LH**, people can wear it and set colors for each lighting unit according to personal preference. After wearing the **HairSlice** units and making the connection with mobile, the wearer can set the numbers and positions of the units through APP named Lighting Hair. Set color for each unit according to personal preference (Figure 4). After wearing **HairSlice** units, gesture control is involved to control ON/OFF and lighting intensity of the **HairSlices**.

Reproducibility and customizability are instincts of fashion. For **LH**, the appliance of optical fiber allows wearers to customize their own appearance. Besides, the unique appearance of optical fibers with loose end also provides more aesthetes in dynamic. To clearly show how LH works, the following content describes it without form customization.

## Interactive Scenarios

*Scenario 1: Ambient awareness*
**LH** is designed to be aware of ambient. According to the photosensor embodied in SmartBand, **HairSlice** units keep off in bright ambient and turn on in dark ambient. Besides, with the mobile APP, **LH** can also display lighting colors according to digital pictures.

*Scenario 2: Affective Visualization*
Another concept about **LH** is to visualize human's emotion. Arousal is a vital element in PAD emotion theory[7]. HRV can reveal people's arousal situation [7]. Since color has a great performance to express affective according to psychological and physiological theories, here we brought dynamic colored lighting to indicate the wearer's arousal situation according to heart rate detected with the heart rate sensor.
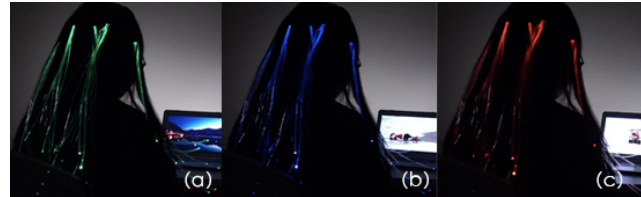


**Figure 5.** Affective visualizations for (a) calm, (b) sad and (c) happy

Green and slow dynamic lighting is for low heart rate to express calm. Blue and medium dynamic is for medium heart rate to express sad. Red and fast dynamic is for high heart rate to express happy. Notice the affective cognition with heart rate may not accurate here, and need more experimental data support.

*Scenario 3: Social Interaction*
Different wearers can contrast a social network. In entertainment scenarios such as party or living concert, different wearers can change colors of **LH** for each other through mobile APP.

During the interactive process, such openness experience can help to evolve a game-like, interesting feeling for the wearer who change the color. For whom being changed, he/she can experience surprise and joy.

And for others, they will observe and enjoy the color-changing.



**Figure 6.** Interaction in entertainment scenario

## Conclusion and Future work
Through exploration of different scenarios, it can be seen that bringing digital and intelligent elements into hair decoration provides new functions and aesthetic expressions of hair decoration. Except for the ability of decoration our appearance, it can also become a data collection and display interface.

For future work, we will explore more interactive possibilities, such as interacting with sound or music. Involving and incorporating additional sensors and display. This will bring more applications in entertainment，sport and fashion.

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