An Eyeglass to Present Information to a User and Others Separately by LED Blinking

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Abstract. We propose an eyeglass to present information to a user and others. The proposed eyeglass is equipped with LED tapeson the outside and the inside of its edges. We also propose some applications that control LED blinking of the proposed eyeglass. In addition, we apply the proposed system in a variety of situation. We discuss about the effectiveness of the system in those situations.

Keywords: Wearable computing · Eyeware · LEDs
Information indications

1 Introduction

In recent years, wearable devices attract much attention with the miniaturization and the improvement of computers. They are used to present information to a user. There are many studies that present information with wearable devices. One is a person that is wearing a wearable device (referred to as user). The other is persons that are looking user's device (referred to as others). For example, FUN'IKI Glasses present the same information to a user and others. However, they are lacks of privacy protection. Because they present information that only user needs to others. Misawa and Rekimoto have proposed ChameleonMask as a system that presents information to a user and others separately [1]. This system presented information with the video to a user and others to aim at tele-presence. In this research, third parties present information to a user and others by remote control from another environment. However, a user presents information that the user wants himself/herself in the same environment as others. Moreover, he/she presents the intention of user and information of user to others. By presenting information to a user and others separately, the user can receive the notification, the navigation, and so on. The user can also communicate with others.

In this paper, we propose the system that presents information with an eyeglass to a user and others separately. The proposed system use the user's peripheral vision. Because the visual workloads is less. Also, although the user can look

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at the inside of an eyeglass, he/she cannot look at the outside of it. In contrast, although others can look at the outside of an eyeglass, they cannot look at the inside of it. The proposed eyeglass is equipped with 20 LEDs on the outside and the inside edge of the eyeglass.

2 Application

We propose a various of applications to present information to a user and others. In this research, we propose more than 80 applications. Table 1 shows examples of those applications.

Table 1. Application examples

Situation	Function	
	A user	Others
Working	Reciving emails	Time signal
Time management	Timer	Timer
Reading	Bookmark	Concentration
Photo	Selfie angle	Light effect to face
Sleeping	Sleeping prevention	Sleep state
Interpersonal	Labeling others	User's color
Talking	Logging contents	Secret talking
Shopping	Coupons	Store introduction
Feeling	Mental care	False feeling
Impression	Control others's image	User's image
Moving places	Navigation	Traffic information
Wexting	Warning to user	Warning to others
Walking	Guiding user's behavior	User's winker
Labeling action	Controlling action	Start and end of action
Party	People with a taste	Unity sense of atmosphere
Game	Hit point	Signals for peers
Running	Time and distance	Fatigue
Music performance	Tempo	Communication
Muscle training	Count to do sit-up	Exercise amount
Sport	Score	Sign

3 System Design

In this study, we propose the device that can present information to a user and others separately. In this research, we aim to construct a system that presents information related to a variety of situations such as daily life and sports.

3.1 System Requirement

When the system present information to a user and others separately, each information is required to be different. In this research, the system is designed based on the following policy.

- Individualization of presenting information
- Presenting information with low visual workloads
- Visibility to others

First, we describe the individualization of presenting information. The proposed system presents different information to a user and others. On the proposed system, a user can get information that he/she needs. Also, others can get information that a user indicates. Next, we proposed the system that presents information so as not to make a user's eyes tired. Finally, it is necessary that the LED position is the place where others visually recognize easily in order to present information to others.

3.2 Proposed System

First, Fig. 1 shows the proposed device. We used JINS MEME, as eyeglass device. In addition, ten full color LED tapes were attached to the inside and the outside of the edges of it at intervals of 11 mm each. Moreover, in order to insulate the circuit part of the LED tape, edges of the eyeglass were coated with silicone rubber. We used Adafruit Feather 32u4 Bluefruit LE as a microcomputer board to control the LEDs. Also, the device was equipped with a 300mAh lithium ion battery. We use iPhone to control LED. They communicate by Bluetooth Low Energy. Next, Fig. 2 shows the application screen of Controller. In this study, we implement five functions to control LED in the proposed applications. They are winker, BPM controller and timer. Winker is that blinking LEDs indicating top, bottom, left and right. A user can switch the part presenting information to the inside and the outside. Timer is that blinking LEDs in a way to notify the remaining time in minutes. A user can set the time freely. BPM controller is that blinking LEDs at a tempo from 60 to 200 bpm inside of the device. A user can set BPM freely.

Fig. 1. Overview of the proposed method

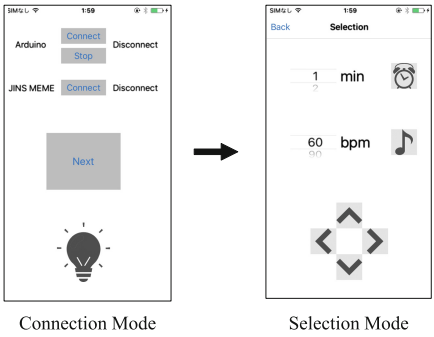

Fig. 2. Controller

4 Experiment

There are three targets presented information by the proposed device: a user, others, and both a user and others. We investigate to present information to a user and others separately. It is required to investigate whether presenting information to a user and others is possible in the assumed situation with the proposed device. Also, it is required to investigate whether the function of presenting information to a user and others is useful. Therefore, we asked subjects to use the proposed device in the four situations, game of scissors-paper-rock, presentation, musical instrument performance, typing in this experiment. Additionally, we asked subjects to answer the questionnaire after the experiment. From the results, we discussed the usefulness of the proposed device.

4.1 Procedure

In the game of scissors-paper-rock, we presented information to both a user and others. First, we told subjects (a user) wearing the proposed device to do the game of scissors-paper-rock against the experiment collaborator (others) in experiments targeting a user. Next, we told subjects (others) to do the game of scissors-paper-rock against the experiment collaborator wearing the proposed device (a user) in experiments targeting others. When we know the result of the scissors-paper-rock, we presented subjects the blinking pattern shown in Fig. 3. In the presentation, we presented information to both a user and others. A user

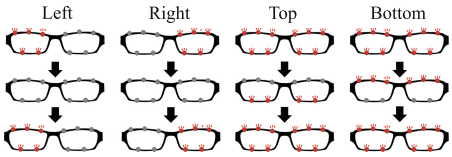

Fig. 3. Light pattern

Table 2. The average ratio of times subjects pointed their finger [%]

	Direction pointed the finger			
	Top	Bottom	Left	Right
Blinking top side	23.8	19.2	32.9	24.1
Blinking bottom side	21.7	23.3	37.5	17.5
Blinking left side	21.7	11.7	40.8	23.3
Blinking right side	28.3	16.7	25.8	31.7

Table 3. The average ratio of times subjects shook their head [%]

	Direction shook the head			
	Top	Bottom	Left	Right
Blinking top side	17.1	35.8	11.7	35.4
Blinking bottom side	26.7	25.0	23.3	25.0
Blinking left side	28.3	30.0	23.3	18.3
Blinking right side	24.2	23.3	22.1	30.4

wore the proposed device as a presenter. We presented the presenter the presentation tempo, notification that the presenter faces downward and timer function with blinking LEDs. Others listened to the user's presentation as the audience. Moreover, we presented the audience the noteworthy parts of the presentation, a user's tension state and timer function with blinking LEDs. In the musical instrument performance, we presented information to the user. The subjects played drums according to the metronome tempo. Moreover, they did it to the tempo blinking LEDs with the proposed device. Tempo presentation by proposed device blinks LED according to BPM. In the typing, we presented information to the user. The subject wearing the proposed device inputted 100 words of 2 to 10 characters displayed on the PC. In addition, the device would pay attention by LED blinking if we recognize their postures got worse by the sensor data from the device.

4.2 Result

In the experiment of the game of scissors-paper-rock targeting a user, there were many subjects who answered that they did not change their direction of movement by the blinking LED. Because the presentation of light was not visible because the position of the LED shifted depending on the weight of an eyeglass. In the experiment targeting the others, we focused on the average times that subjects point their finger after winning in the scissors-paper-rock when they saw the LED blinking in four directions (Table 2). Moreover, we focused on the ratio of the average times that subjects shook their head after losing in the scissors-paper-rock when they saw the LED blinking in four directions (Table 3). There was no particular change in their behavior by the blinking LED. They answered that they thought that the direction of the blinking LEDs was the same as the direction that the experiment collaborator moved. Thereby, when subjects won the scissors-paper-rock, they did an action to win the game to point their finger in the direction of the blinking LED. However, they answered that they ignored blinking LEDs in the remaining trials. Because they responded that the direction of blinking LEDs and the direction of movement of experiment collaborator actually differed. In the presentation, the presenter answered that he did not recognize the light much. In addition, he answered that it is because he was concentrating on the presentation. We assume this is because the light intensity of the LED was too weak The audience answered that they want to use the notification to the noteworthy parts of the presentation and the timer

as a function. Moreover, they answered that they could not concentrate on the presentation because they were concerned about the blinking LED. In the musical instrument performance, more than half of the subjects answered that it was easy to perform tempo presentation by the blinking LED. Half of the people who said that blinking LED presentation is easy to perform answered that the blinking pattern was good. In the typing, from the questionnaire, when subjects received the notification by the blinking LED, they did not recognize that their posture were worse. Half of the subjects answered that the pattern of blinking was easy to understand.

5 Discussion

First, in the experiments targeting a user, there were subjects who said that they could not recognize the blinking LEDs. We consider that because the device case is heavy, the position of the eyeglass is shifted from usual. As the result, the LEDs blinked outside the peripheral vision of the subject. Moreover, based on experimental results of musical instrument performance, it is difficult to listen to tempo presentation by sound in a mixed environment of sound. However, it is intuitive and easy to match to present the tempo visually using the proposed device. We assume that presentation of information to the peripheral visual field is effective in the work environment that presenting information to the auditory sense is difficult. Next, in this experiment, the blinking pattern of LED was the one proposed by the author. Thereby, in the situations other than the game of scissors-paper-rock that we presenting information of "direction", which people can recognize intuitively, the interpretation of the blinking pattern of the LED differs for each subject. Therefore, it is necessary to present information with the blinking pattern of the LED that everyone recognizes easily.

6 Conclusion

In this study, we proposed a device that can present information to a user and others. Additionally, we proposed many applications that device is suitable for use. Therefore, we implemented an eyeglass that can present information to a user and others separately by LED blinking. We evaluated the proposed device under the four situations of the game of scissors-paper-rock, the presentation, the musical instrument performance, the typing. Based on the experimental results, we found that it is difficult to use only the proposed functions under the four situations. In the future works, we will improve the problems such as wearability of devices that we have known through experiments. In addition, we propose other functions in the environment we evaluated in this experiment. Furthermore, we need to investigate the usefulness of the proposed function using the proposed device under other situations.

Reference

1. Misawa, K., Rekimoto, J.: ChameleonMask: embodied physical and social telepresence using human surrogates. In: Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems (CHI EA 2015), pp. 401–411 (2015)