Bionic Scope: Wearable System for Visual Extension Triggered by Bioelectrical Signal

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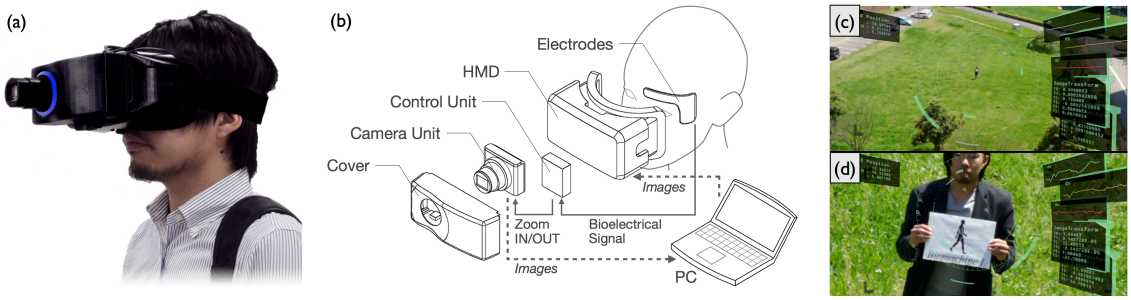

Figure 1: *Overview of the developed visual extension device. (b)Configuration of the developed system. (c)Displayed image by HMD(non-zoom) (d)Displayed image by HMD(zoom-in)*

1 Introduction

Visual extension has been an essential issue because the visual information accounts for a large part of sensory information which human processes. There are some instruments which are used to watch distant, objects or people, such as a monocle, a binocular, and a telescope. When we use these instruments, we firstly take a general view without them and adjust magnification and focus of them. These operations are complicated and occupy the user's hands. Therefore, a visual extension device that is capable of being used easily without hands is extremely useful. A system developed in the previous work recognizes the movement of the user's eyelid and operating devices by using it [Hideaki et al. 2013]. However, a camera is placed in front of the eye, and that obstructs the field of view. In addition, image recognition needs much calculation cost and it is difficult to be processed in a small computer. When human intends to move his/her muscles, bioelectrical signal (BES) leaks out on the surface of skin. The BES can be measured by small and thin electrodes attached to the surface of the skin. By using the BES, user's operational intentions can be detected promptly without obstructing the user's field of view. Moreover, using BES sensors can reduce electrical power, and contribute to downsizing systems.

In this study, we propose a novel wearable system for visual extension system triggered by BES.

Keywords: interface, augmented vision, bioelectrical signals

Concepts: **• Computer systems organization ~ Embedded and cyber-physical systems;** *Embedded system*

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2 Implementation

An overview of the developed system is shown in figure 1(a), and the system configuration is shown in figure 1(b). The developed system consists of a camera unit, a head mount display (HMD), a control unit including a BES measurement circuit, and a personal computer (PC). The camera unit has optical 30x zoom lens and focusing functions. The image acquired by the camera unit is sent to the PC, and processed. The processed image finally sent to the HMD. The electrodes for BES are attached to the user's temples and forehead. The control unit estimates the user's operational intention by using detected BES, and operates the zoom and focusing functions of the camera unit. An image that the user can watch through HMD is shown in fig1(c). A zoomed image is shown in fig1 (d). The user is able to obtain clear images magnified by the optical zoom lens.

This system can distinguish a user's operational intentions by BES. When the user is frowning, the system is zooming in. When the user blinks largely, it zooms out. After each operation, focus adjustment is executed automatically. Therefore, the user is able to use this system without using hands.

3 Conclusion

In this study, we propose a novel wearable system for visual extension system triggered by BES. We can intuitively use this system without using hands. Furthermore, we can watch from near objects to distant ones clearly and seamlessly. It is supposed that this system is useful for various activities such as watching sports and birds, rescue, guard, and surgery.

References

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