Transmission of Color Information Using Human Body Communication

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ABSTRACT

In this study, focused on human body communication (HBC) technology, one of the promising body area network technologies, color information data transmission using HBC technology was investigated. Consequently, the color information data were confirmed to be stably transmittable by the FSK modulation with a 10.7-MHz center frequency through the body.

1. INTRODUCTION

Color has messages and power. For example, “red color” reminds us of various things such as passion, danger, fire, and life. Messages obtained from colors have a great influence on psychological and physical sensations such as feelings, emotions, and impressions. Therefore, colors can be used as a means of communication.

On the other hand, in daily greetings, directly touching with others, such as shaking hands and hugs, is also one of basic communication means in human society.

In recent years, human body communication (HBC) that uses the human body as a part of a signal transmission medium attracts attention as a promising wireless communication method for body area network [1].

In the HBC devices, since the human body is used as a part of the transmission medium, a nonradiative electromagnetic field for communication is distributed around the human body. Therefore, the human body behaves as a part of the transmission medium, and communication between HBC devices arranged on the human body surface can be performed with high efficiency.

In the IEEE 802.15.6 standard, HBC is defined as one of the three physical layers for the body area network [2]. In comparison with other conventional wireless communication technologies such as Wireless LAN and Bluetooth, the HBC is advantageous in terms of its communication secrecy, low power consumption, and intuitive tactile operation. Because of these advantages, the HBC is expected to be utilized in wearable devices for augmented reality and enhancing human ability.

In this research, in order to expand communication means and to expand human ability and augmented reality, the transmission of color information using the HBC is studied.

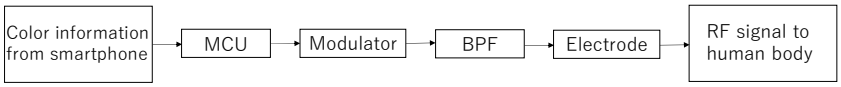
2. SYSTEM CONFIGURATION

Figure 1 shows a block diagram of an HBC system prototyped in this study. In the transmitter shown in Fig.1 (a), the data acquired by a smartphone are sent to a modulation circuit (Modulator) via a microcontroller unit (MCU), and modulated by the FSK modulator with a center frequency of 10.7 MHz, and those modulated RF signals are transmitted to the human body through the band pass filter (BPF) and transmitter electrode.

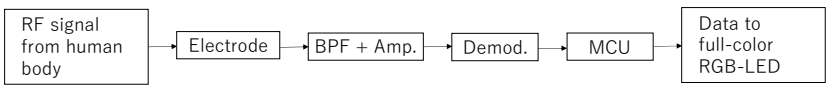
In the receiver shown in Fig. 1 (b), the receiver electrode on the body surface receives the modulated RF signals, which propagate through the human body. The received signals are demodulated by the demodulation circuit via the BPF and amplifier circuit, and the demodulated signals are delivered to the full-color RGB-LED via the MCU. Both transmitter and receiver are powered by the rechargeable battery.

3. LIGHTING COLOR CONTROL

Figure 2 is a photograph of the prototyped transmitter and receiver. In the prototyped system, the user selects the color from the color chart displayed on the smartphone. The chosen color information is sent to the HBC transmitter and the modulated RF signal is transmitted to the human body through the electrode. In the receiver, the



(a) Transmitter



(b) Receiver

Fig. 1 System block diagram

(a) Transmitter (b) Receiver

Fig. 2 A prototyped human body communication system

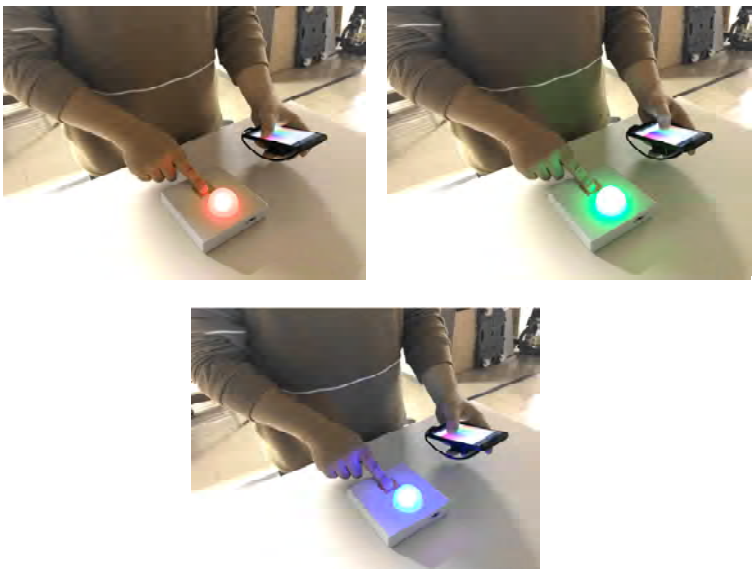


Fig. 3 Lighting color control using prototyped system

RF signal received by the receiving electrode is demodulated and sent to the MCU. The MCU controls the intensity of the three LEDs of full-color RGB-LED by pulse-width-modulation (PWM) based on the received color information data.

Figure 3 shows photographs when lighting color control is performed using the prototype system. As shown in Fig. 3, the color information selected by the smartphone held in the left hand is transmitted through the human body, and the color and intensity of the full color LED in the receiver are controlled.

4. CONCLUSION

In this study, focused on HBC technology, one of the promising body area network technologies, color information data transmission using HBC technology was investigated. Consequently, the color information data were confirmed to be stably transmittable by the FSK modulation with a 10.7-MHz center frequency through the body.

ACKNOWLEDGMENT

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