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Demonstration of Power and FM Wave Transfer on Conductive Textile for Distributed Actuators

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I. Introduction

For more immersive experiences for virtual reality (VR) contents, reproducing tactile sensation is an important element. In addition to commercial off-the-shelf VR devices, enabling whole-body tactile feedback is desired for more intuitive experiences. It requires actuators to be distributed on the whole body; however, if discrete wiring is strung among the actuators, they may cause wire breakage and prevent natural body motion. In this demo, we present a conductive textile-based interconnection of many actuators for more practical implementation of wearable tactile systems (Fig. 1).

II. Motivation and Contributions

As an alternative to individual wiring and wireless transfer, two-dimensional (2-D) communication over conductive textile has been proposed [1]. Conductive textile is a highly redundant transmission path, and has advantages over wires in flexibility and durability, and over wireless transfer in power supply and stability of signal transfer.

In a previous work [1], waveforms are programmed in advance and stored in each receiver's memory. The transmitter only specifies which waveforms to play. It can be used like "sound effects," however, non-stored waveforms, such as realtime-detected or included in new contents, cannot be played. Thus, multi-channel frequency-modulated (FM) signal communication over the 2-D conductive textile has been proposed [2]. Unlike the pre-program method [1], the arbitrary waveforms to drive actuators are transferred via the 2-D conductive textile. FM signals can be demodulated by a commercially available FM radio receiver IC, which is tiny and low-cost. Each receiver is tuned to a pre-defined channel, i.e., a uniquely assigned frequency of the FM carrier.

On the other hand, the transmitter is required to modulate many carriers, corresponding to many receivers, simultaneously. Commercially available FM transmitters are not designed to operate that way. Previous work [2] demonstrated the principle feasibility of FM transmission using a function generator, however, a practical implementation method of multi-channel FM transmitter has not been clarified.

Thus, we propose to use a software-defined radio (SDR) as a multi-channel transmitter [3]. In this demo, we show an SDR-based tactile feedback device using 2-D conductive textile, which can reproduce arbitrary vibrotactile sensations with many distributed actuators.

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References

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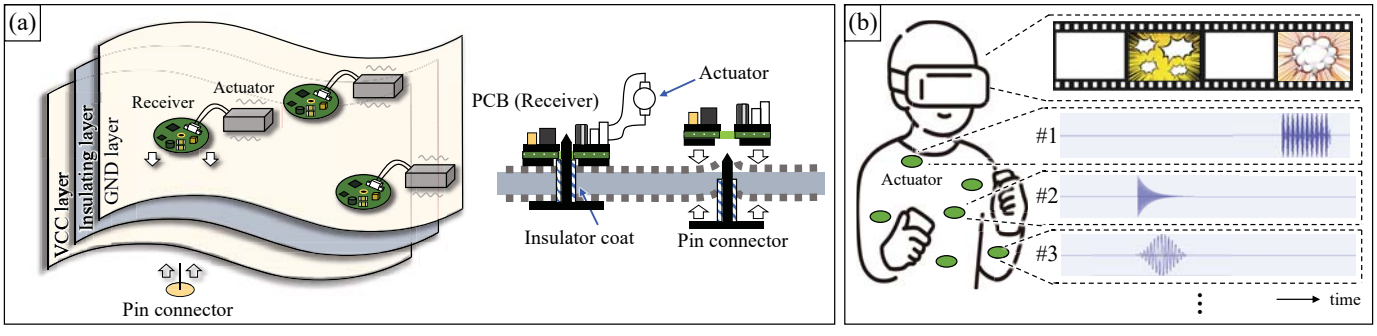

Fig. 1. (a) Structure of the 2-D conductive textile, overview (left) and cross-sectional view (right). Two conductive textiles (VCC and GND layer) are insulated by inserting a normal textile (insulating layer) between them. Each receiver is attached to the 2-D conductive textile by each pin connector.(b) An example of concept of this work. Appropriate tactile stimuli are required to be synchronizing with video or user operation, which depends on the contents.