

Live Demonstration: Bioimpedance-Based Interaction for Virtual Reality

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Abstract—This work presents a novel interaction method using bioimpedance (Bio-Z) to enhance virtual reality (VR) experience. The platform consists of two electrode bands (with 4 and 5 electrodes), a high-performance bioimpedance measurement system, a recurrent neural network deployed on a laptop and a VR headset. The system captures the Bio-Z features from muscle contraction and bone movement in the wrist and upper arm. After training, the regression model can predict hand grasp angle and forearm motion in both horizontal and vertical directions. This system can be used as a VR human-computer interaction (HCI) peripheral. Visitors will experience VR games using this demonstration platform.

I. INTRODUCTION

Bioimpedance (Bio-Z) variations in the upper limb muscles can inherently reflect movements of the upper limb generated by extension and contraction of the muscles. Bio-Z can be measured by injecting an ac current and recording the induced voltage potentials on the skin. This non-invasive method, which captures muscle and bone movement through changes in impedance, has been widely studied and applied to hand gesture recognition [1]–[3]. Predicting motion angles through regression will further enhance the application value of Bio-Z in human-computer interaction (HCI), offering an alternative virtual reality (VR) interaction method beyond traditional camera-based approaches. In this work, hand grasping simulates a left mouse click, while forearm motion enables mouse movements or arrow key functions.

II. LIVE DEMONSTRATION SETUP

Fig. 1 shows the proposed HCI platform for VR games, which comprises the following components:

- **Two Bands:** The wrist-worn band equipped with 4 electrodes enables hand grasp angle prediction. The upper arm-worn band with 5 electrodes supports forearm motion prediction.
- **Bio-Z Measurement System:** The system is adopted to acquire Bio-Z features at a rate of 140 samples per second from 9 electrodes [4].
- **Neural Network:** The recurrent neural network, deployed on a laptop, is used to predict the motion.
- **VR Headset:** The headset provides an immersive platform for VR experiences.

III. VISITOR EXPERIENCE

This live demonstration will allow visitors to play VR games by wearing two soft electrode bands and a VR headset. First, visitors will be instructed to perform several actions to collect Bio-Z data and tune the trained neural network. Visitors can then interact with the VR headset interface by quickly opening and closing their hands to click an option and moving their forearms to control the cursor position. This interaction method will be further experienced through playing games like Spaceship War, Pong, and Dino.

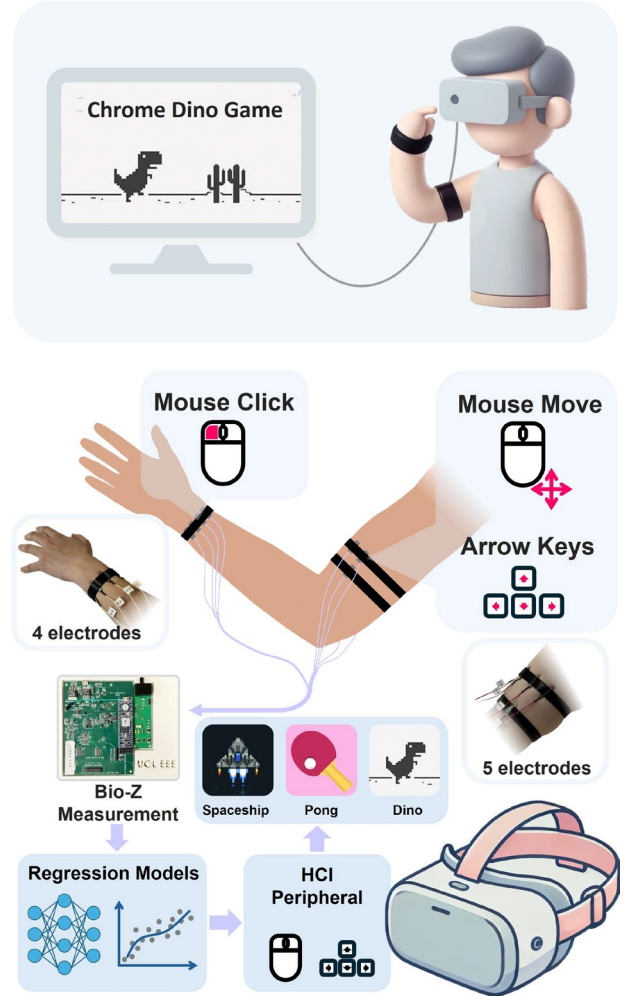


Fig. 1. Overview of the proposed interaction method for virtual reality.

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