

Supplementary File

Minimalist Design for Multi-Dimensional Pressure-Sensing and Feedback Glove with Variable Perception Communication

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Text S1. Delays when processing the signals of both sensors

By connecting the sensing units to the voltage divider circuit and reading the output change in the circuit, the working status of the sensors can be directly analyzed. Since each pressure-sensing unit and bending-sensing unit outputs a single voltage signal only, it is capable of measuring the pressure and bending angles with sufficient accuracy without any complex processing. Therefore, the delay of the two sensors can be directly determined by calculating the difference between the moment when the hand movement commences and the moment when the signal starts to fluctuate. We had a volunteer wear our sensing and feedback glove and recorded the entire process of the volunteer holding the test tube at 240 frames per second using a video camera. We intercepted a frame when the finger starts to bend but there is no signal yet (Figure S3a), a frame when the finger bends and the signal just appears (Figure S3b), a frame when the fingertip contacts an object but there is no signal (Figure S3c), and a frame when the fingertip contacts an object and the signal appears just at the right moment (Figure S3d), respectively.

The delays when processing the signals of both the pressure sensor and bending sensor are shown in Figure S4 in a frame-by-frame analysis, and the results indicate that the delay ΔT_1 and ΔT_3 when processing the signal generated by the bending sensing unit and the pressure sensing unit and the delay ΔT_2 and ΔT_4 when processing the recovery signal of both sensing units are 433 ms, 400 ms, 383 ms and 400 ms, respectively, meaning that both sensors have a delay of approximately 400 ms.

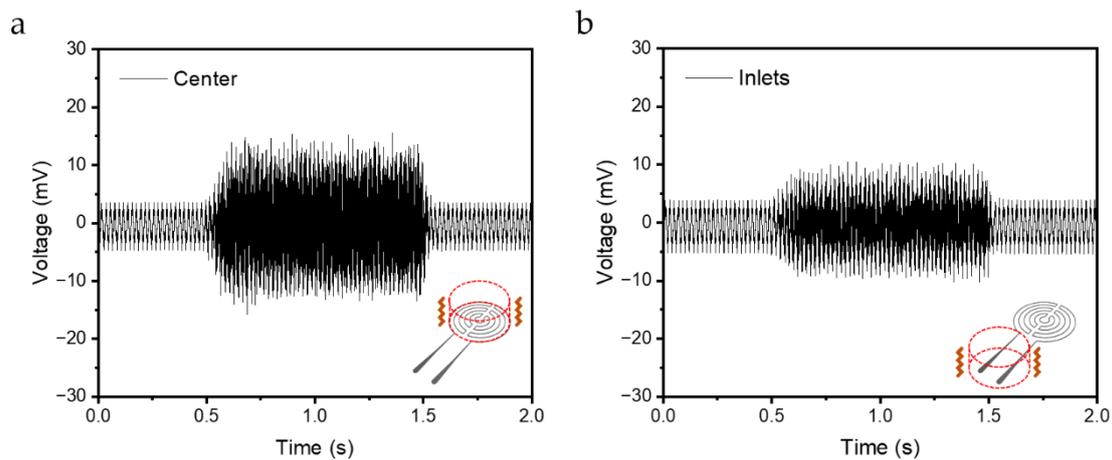


Figure S1. Comparison of the triboelectric output when the coin vibrator is placed in different positions. (a) Center of the pressure sensor; and (b) inlets of the pressure sensor.

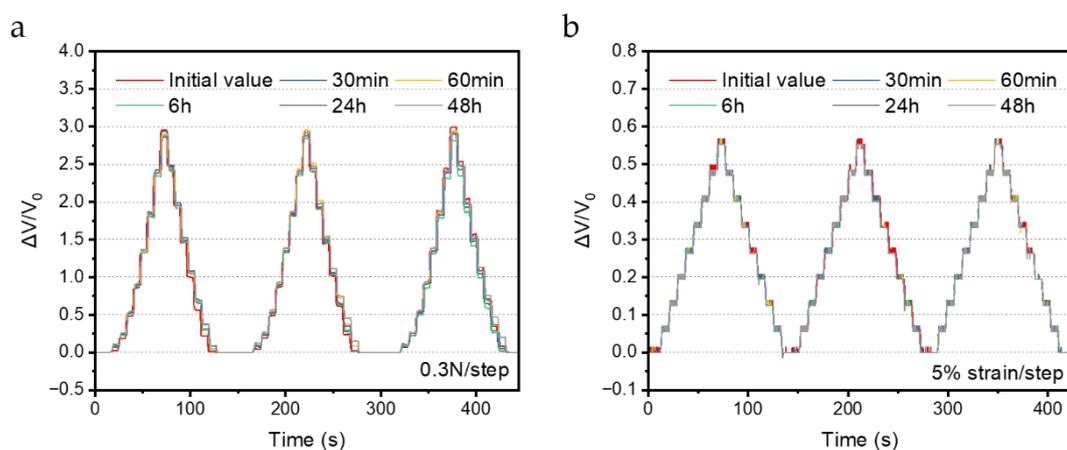


Figure S2. Cyclic test of the long-term operation of the pressure sensor and bending sensor.

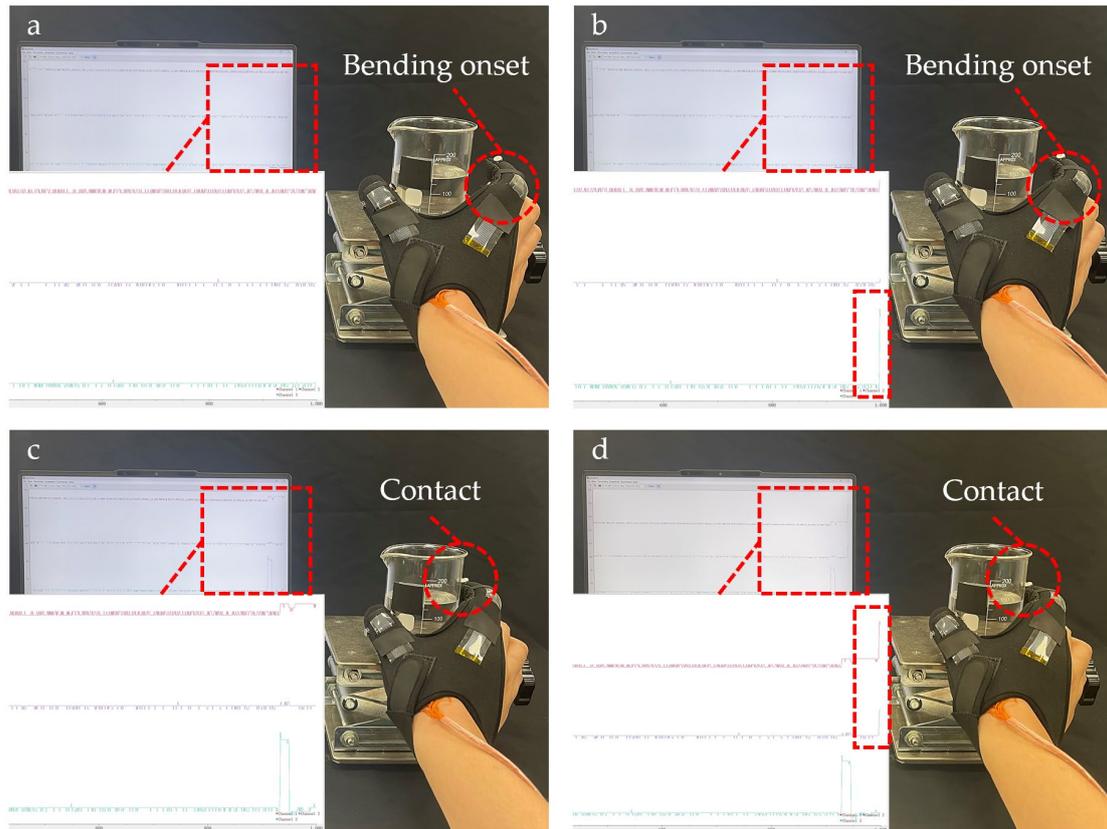


Figure S3. Characterization of the delays of both sensors when holding a beaker. (a) Bending state with no signal, (b) bending state with signal emerging, (c) contact state with no signal, and (d) contact state with signal emerging.

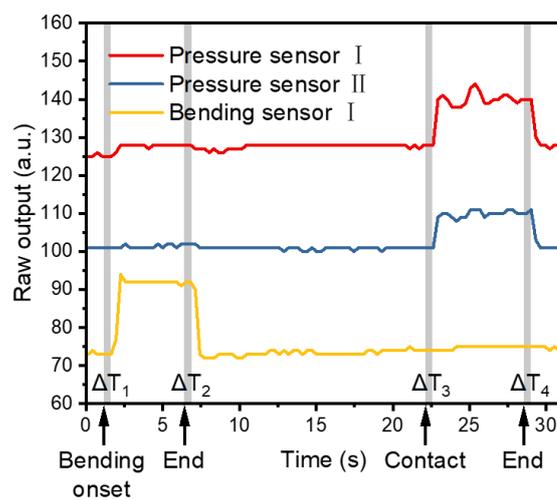


Figure S4. Delay when processing the signals of both the pressure sensor and bending sensor.