

Supporting Information

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Wearable triboelectric sensors enabled gait analysis and waist motion capture for IoT-based smart healthcare applications

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Figure. S1. Schematics of the fabrication process of the textile-based triboelectric sensor with pyramid structures.



Figure. S2. Testing devices for the optimization of TENG's performance



Figure. S3. Characterization of the TENG sensor with different structures and triboelectric materials. (a) Dimensions of the pyramid structures. (b) Open-circuit voltages of the TENG sensor with different pyramid structures or without pattern under 100 N compressing force and 0.5 Hz frequency. (c) Open-circuit voltages of the TENG sensor with different positively triboelectric materials under 100 N compressing force and 0.5 Hz frequency, where pyramid structure is in size of 3 mm.



Figure. S4. SEM images of the aluminum layer and Ni-fabric layer. (a)-(b) SEM images of aluminum layer with 300 μ m and 100 μ m. (c)-(d) SEM images of Ni-fabric layer with 300 μ m and 100 μ m.



Figure. S5. Diagrams of the as-fabricated textile-based TENG devices. (a) Silicone rubber layer with designed pyramid structures. (b)-(d) Images of the flexible TENG sensor. (e) Image of the as-fabricated safety belt with four TENG sensors. (f) Smart insole with TENG sensors for rehabilitation training.



Figure. S6. Characterization of the as-fabricated TENG sensor. (a)-(b) Open-circuit voltages of the TENG sensor under different compressing forces. (c) Average peak voltage value of five tests. (d) Short-circuit currents of the TENG sensor. (e) Transferred charges of the TENG sensor.



Figure. S7. Output characterizations at different compressing speeds. (a)-(c) Open-circuit voltages, short-circuit currents and transferred charges of the TENG sensor with 50 N compressing force at different compressing speeds. (d)-(f) Open-circuit voltages, short-circuit currents and transferred charges of the TENG sensor with 100N compressing force at different compressing speeds. The unit of compressing speed in this figure is mm/min.



Figure. S8. Demonstration of lightening 55 LEDs by the TENG sensor.



Figure. S9. Open-circuit voltages of the TENG at different temperatures.



Figure. S10. Schematic diagram of the circuit to measure the real-time TENG signal.



Figure. S11. Voltages for the vehicle control based on the TENG sensor embedded into the safety belt. (a)-(c) Turning left, going forward and turning right of the vehicle by compressing W-TENG-1, W-TENG-2, and W-TENG-3 respectively.



Figure. S12. Characterization of the force on the forefoot during walking. (a) Device of the characterization. (b) Force values on the forefoot for different periods of walking.



Figure. S13. Methods and results for measuring real-time walking speed based on TENG-based smart insole, where each step matches the spots on the ground.



Figure. S14. Schematics of the process and parameters for constructing the ANN structure, where BN represents Batch Normalization.



Figure. S15. Cross-entropy loss function results for smart insole-based patient recognition with different fully connected layers (FCLs). (a) The result for training loss and (b) validation loss for 10 epochs of training. (c) The result for training loss and (b) validation loss for 100 epochs of training.



Figure. S16. Structure of the rehabilitation robot (iReGo). (a)-(b) Images of iReGo. (c) Rehabilitation training with the safety belt to support the patient. (d) Schematic of human wearing the TENG-based safety belt and smart insole.