

Supplementary Information

Maximizing energy efficiency with a mirror-structured hybrid generator leveraging triboelectric and photovoltaic cells for optimal coverage and wind awareness

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1. Water contact angle values for the bare Al and bare FEP film

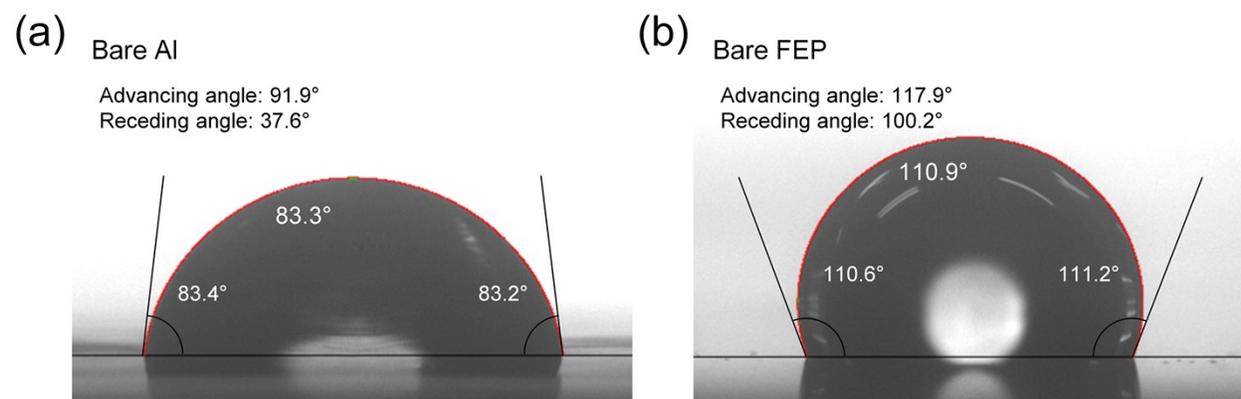


Fig. S1 Results of the contact angle measurement with (a) bare Al and (b) bare FEP film-cases.

2. Operating mechanism and simulation results of wind TENG

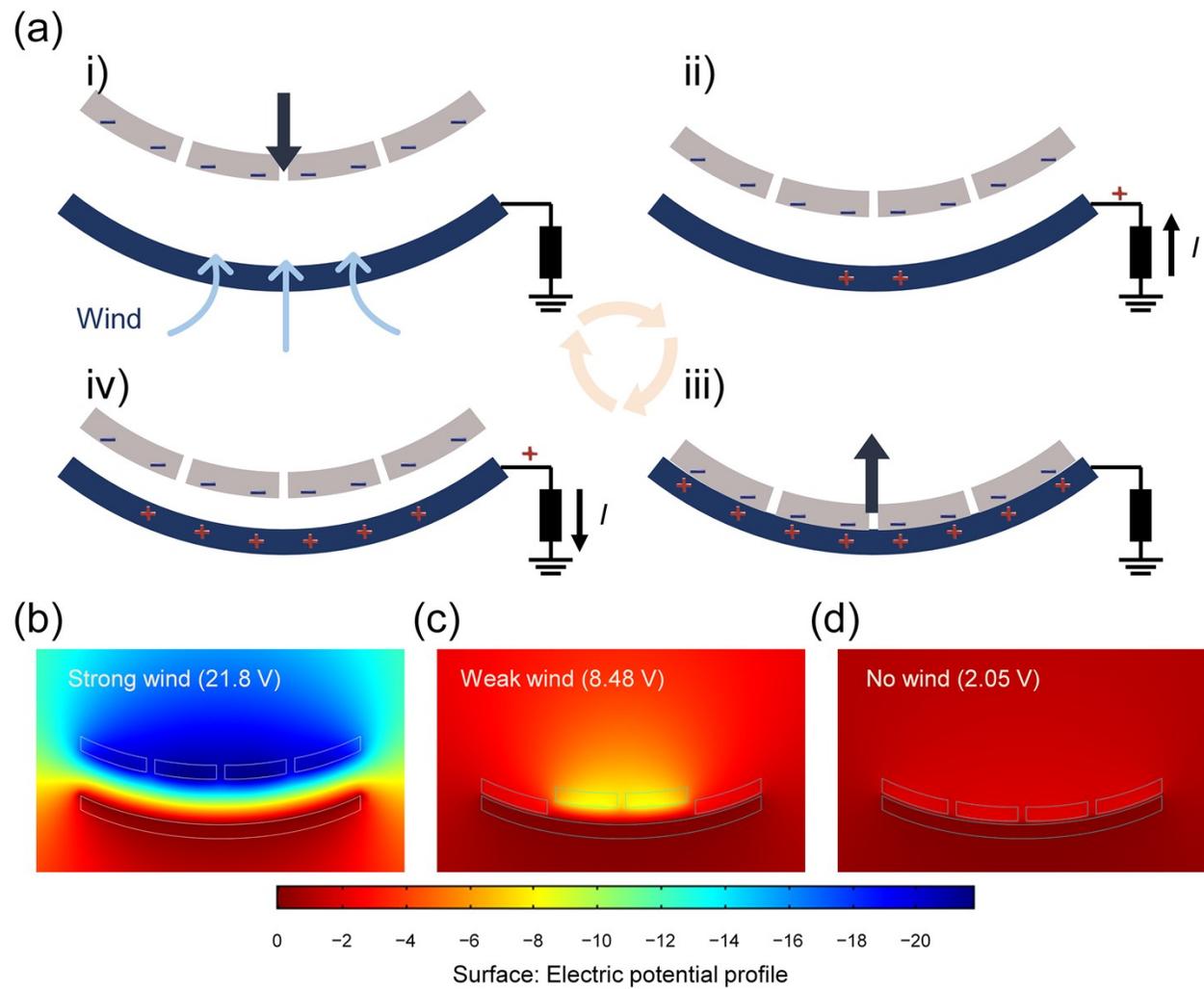


Fig. S2 Operating mechanism and finite element method (FEM) results of the wind TENG. (a) Detailed operating mechanism. FEM results with (b) the strong wind-condition, (c) weak wind-condition, and (d) without wind-input.

3. Electrical outputs of the PV cell with/without SAM

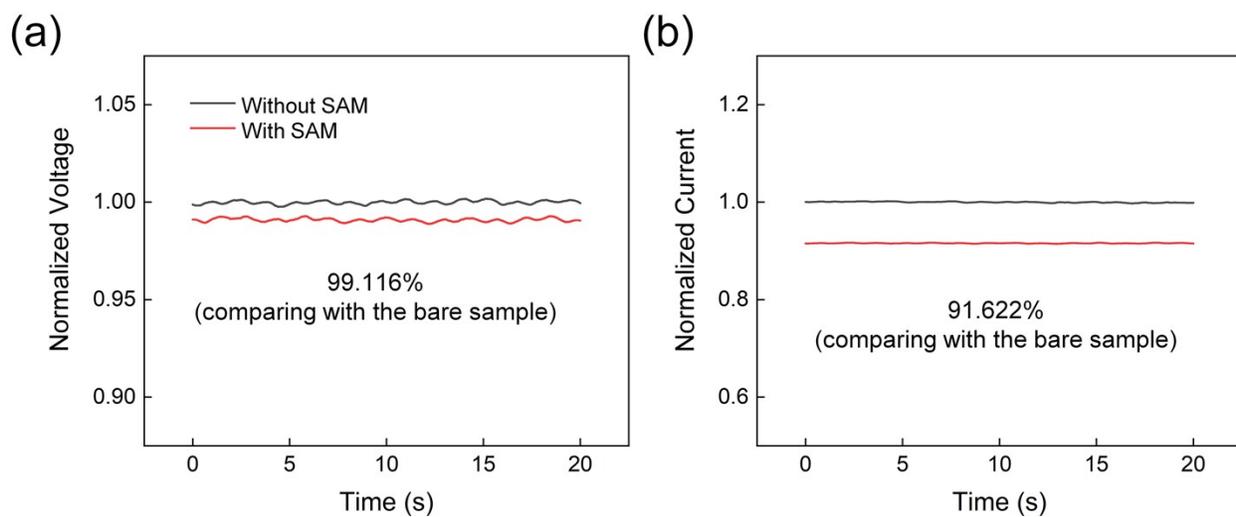


Fig. S3 (a) Normalized voltage and (b) normalized current signals generated from the PV cell with/without the self-assembled monolayer on the Al mirror layer.

4. Output voltage profiles with mirror-based PV cell

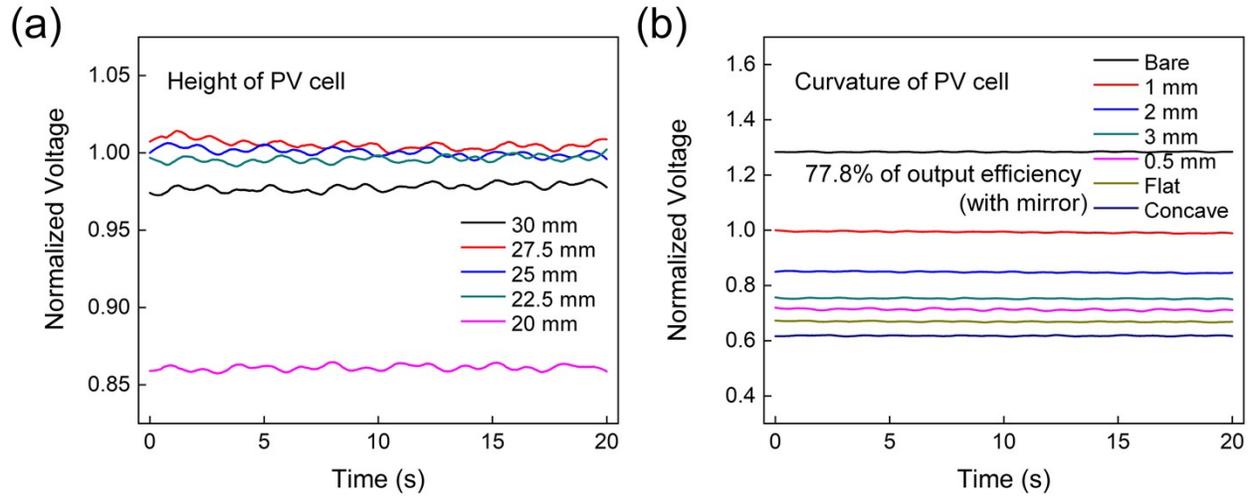


Fig. S4 Values of output voltage from the PV cell with changing conditions. (a) Changing the height of the PV cell. (b) Changing the curvature of the PV cell.

5. Schematic for the directionality tests with the mirror-based PV cell

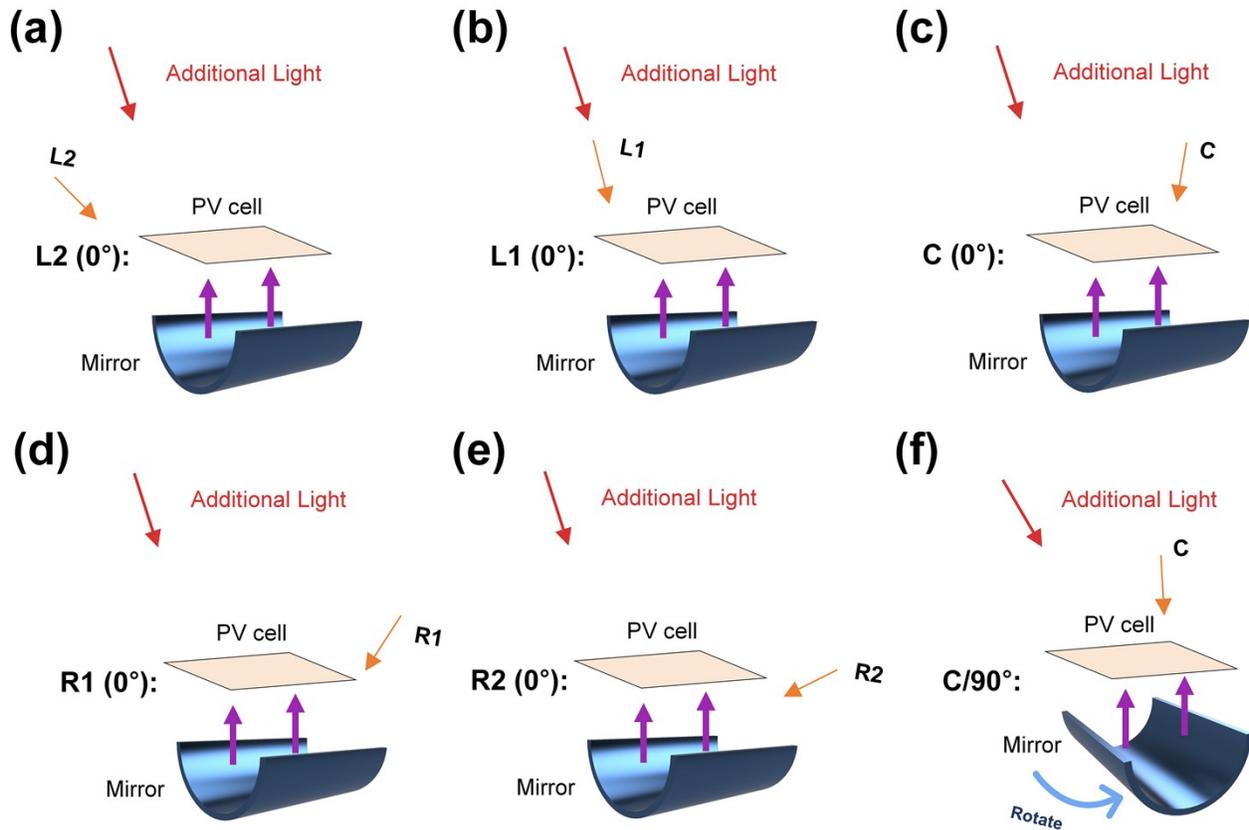


Fig. S5 Schematic diagram for elucidating the measuring condition for checking the directionality with (a) L2, (b) L1, (c) C, (d) R1, (e) R2, and (f) C/90°-cases.

6. Effect of SiO₂ powder with increasing the injection number of wind

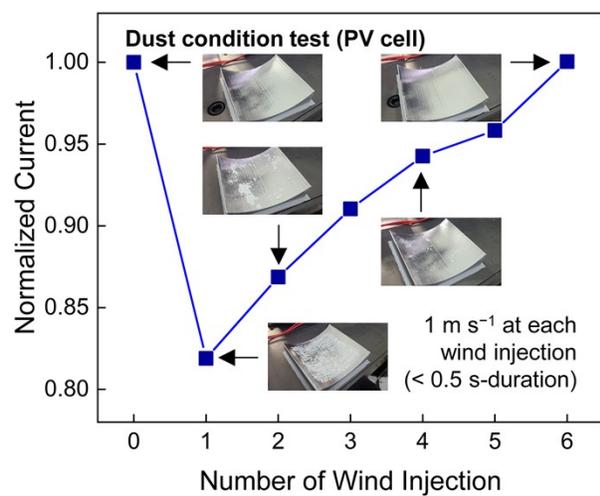


Fig. S6 Normalized current values of the PV cell with adding the SiO₂ powder and increasing the injection number of the input wind.

7. Basic electrical outputs of wind TENG

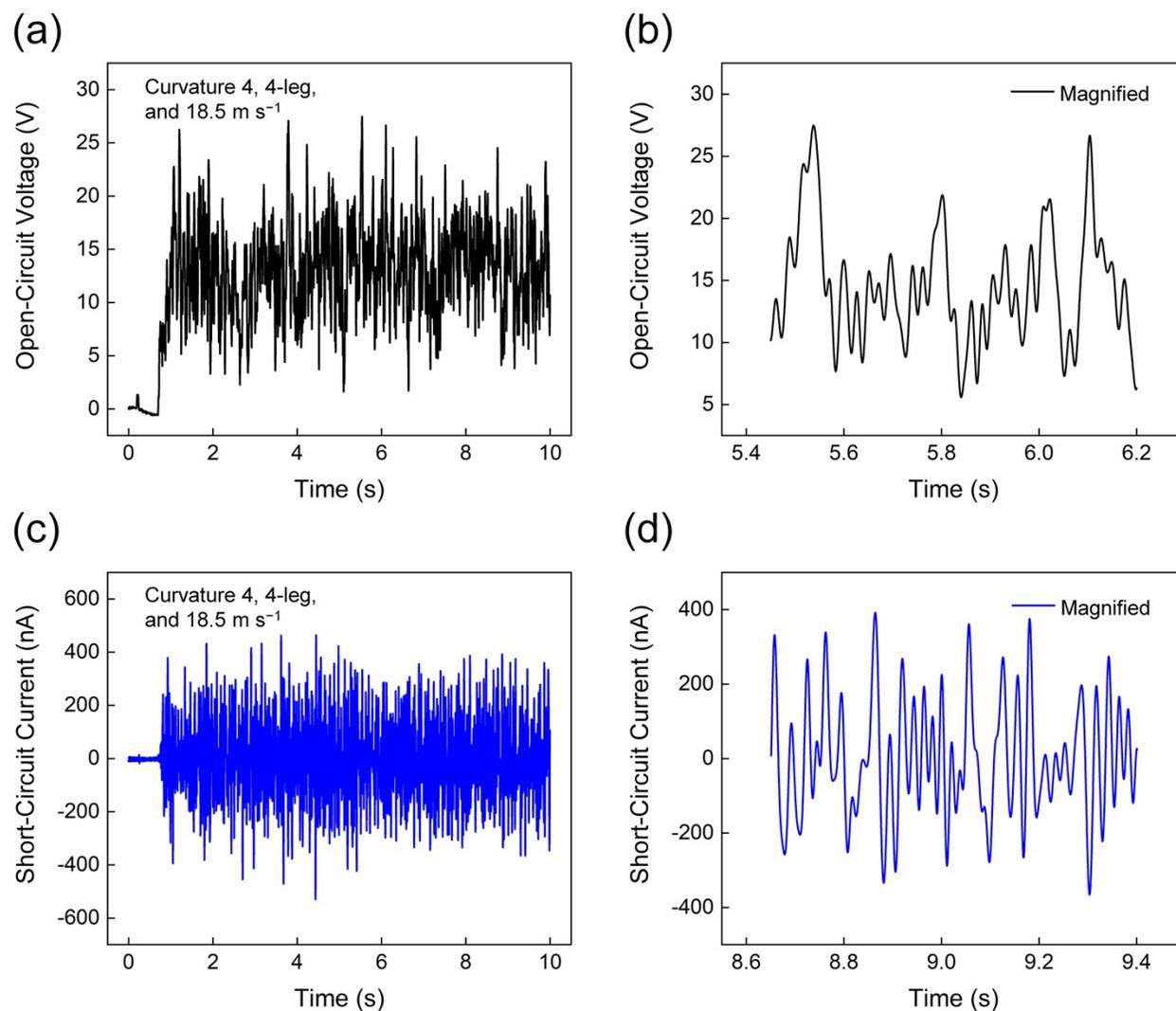


Fig. S7 Basic electrical outputs with magnified peaks of wind TENG. (a) V_{OC} and (b) its magnified peak. (c) I_{SC} and (d) its magnified peak.

8. Durability test for the wind-TENG with continuous wind input

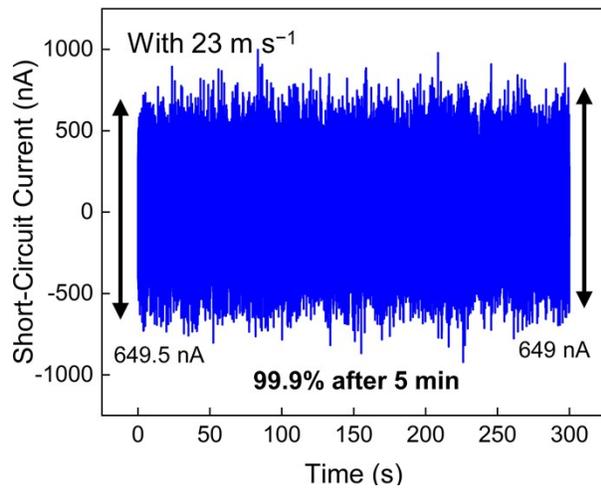
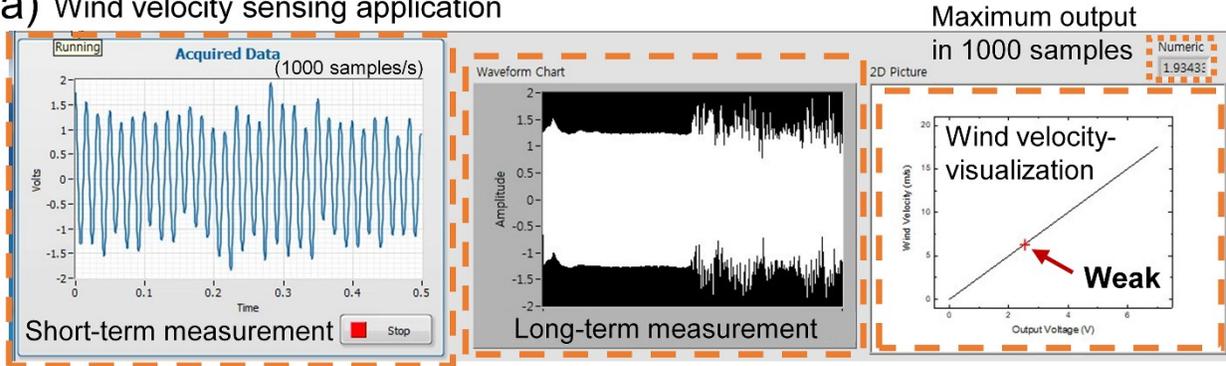


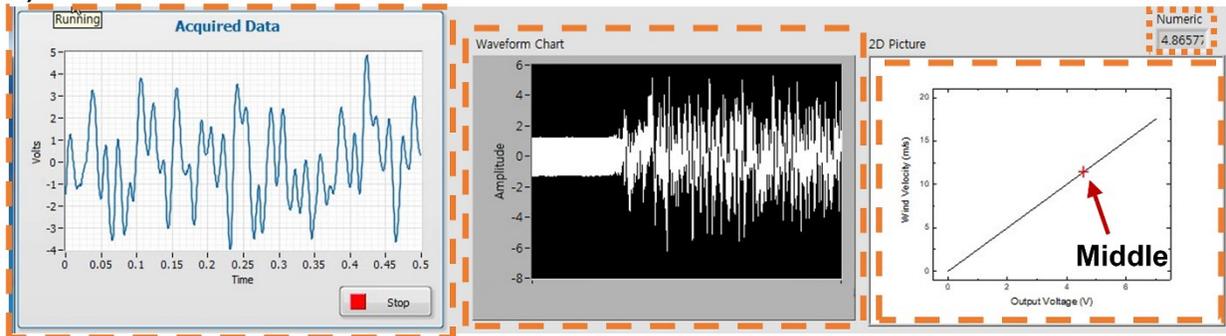
Fig. S8 I_{SC} from the wind-TENG for the durability test during 5 min-injection of wind.

9. Wind sensing application with weak, middle, and strong-intensity

(a) Wind velocity sensing application



(b)



(c)

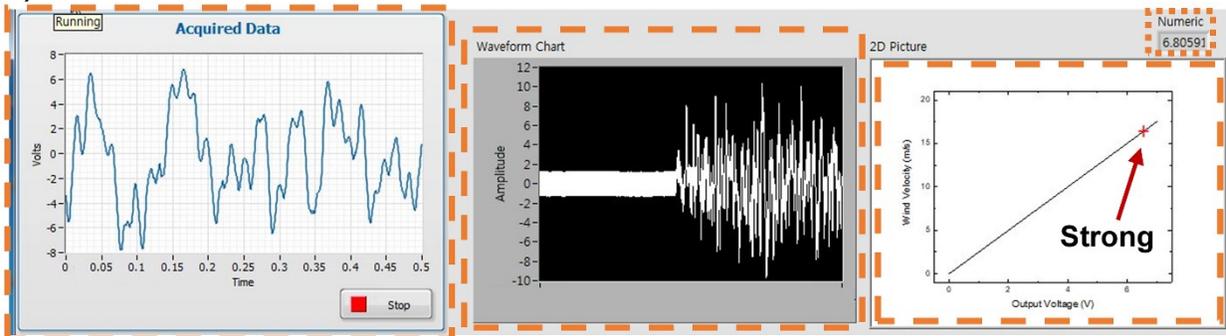


Fig. S9 Captured images of the wind sensing application with (a) weak, (b) middle, and (c) strong intensity of wind-input conditions.

10. Video of wind sensing application with weak input

Video 1 Wind velocity sensing test by wind TENG with weak input.

11. Video of wind sensing application with middle input

Video 2 Wind velocity sensing test by wind TENG with middle input.

12. Video of wind sensing application with strong input

Video 3 Wind velocity sensing test by wind TENG with strong input.