Supplementary Materials

Triboelectric discharge based self-powered wireless sensing system for smart home application

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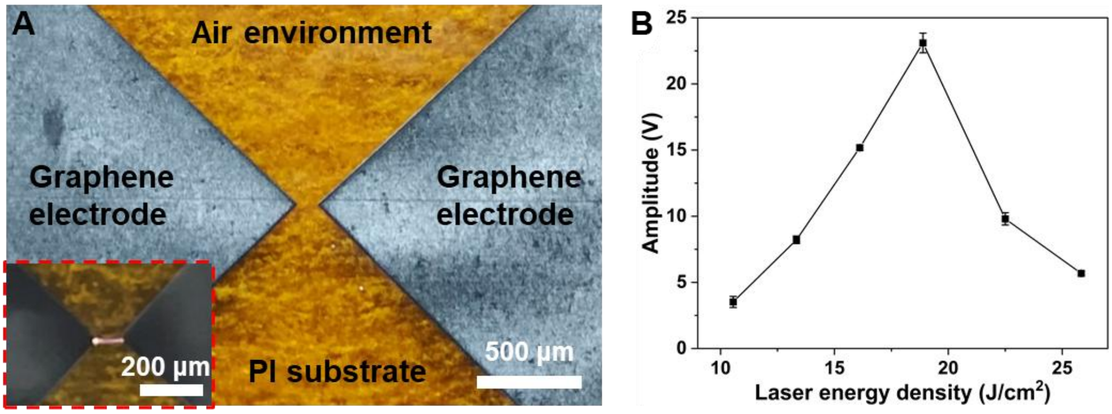
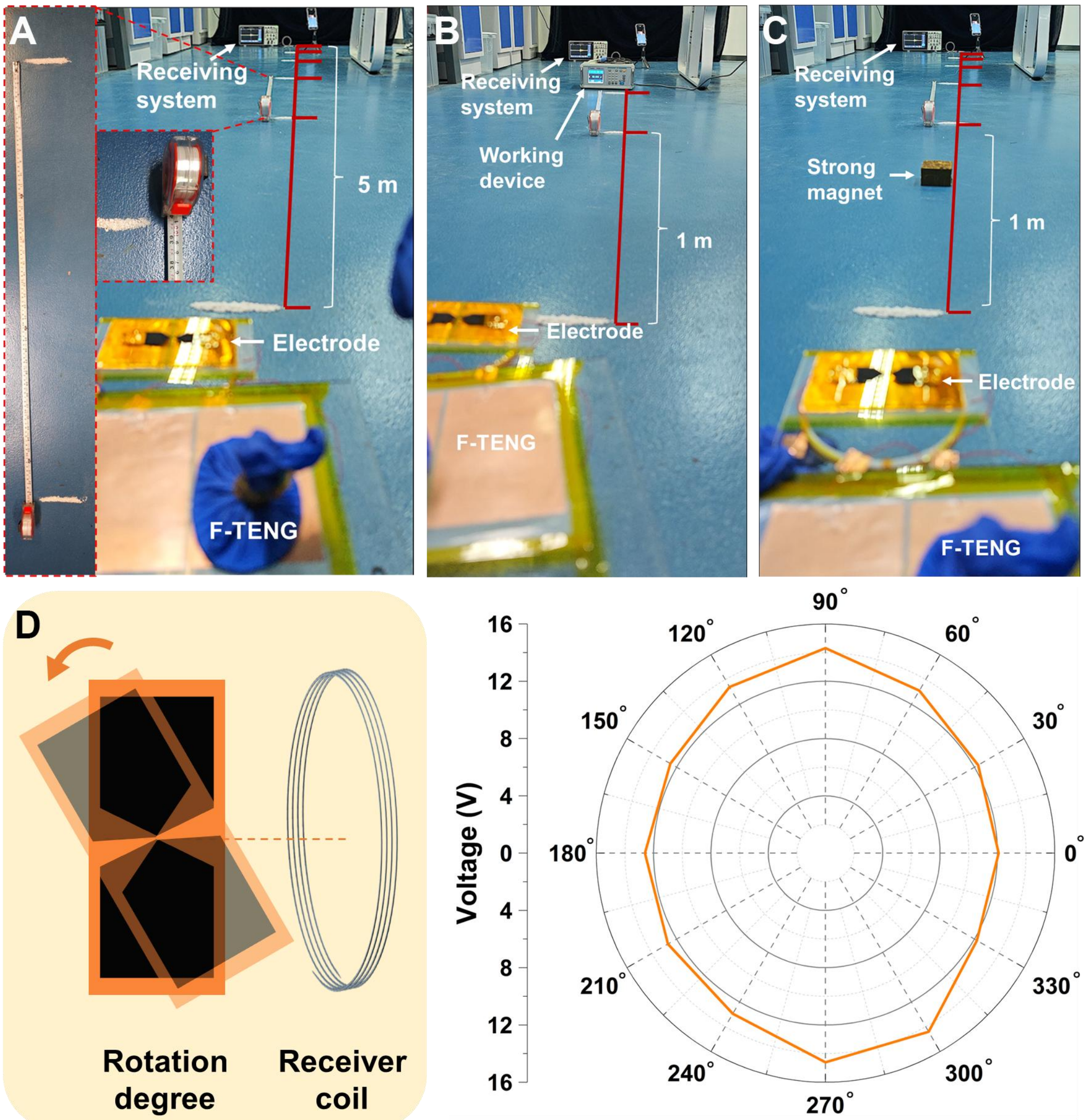
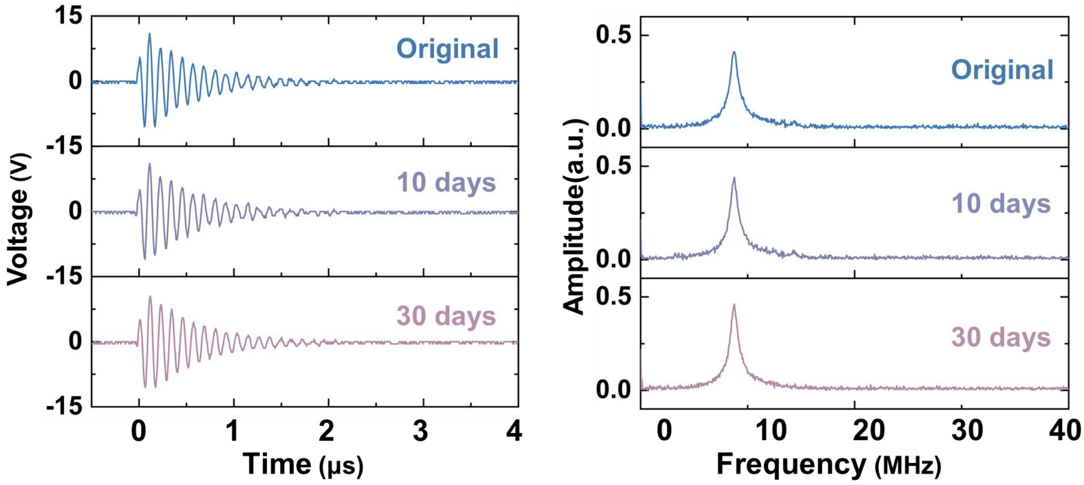


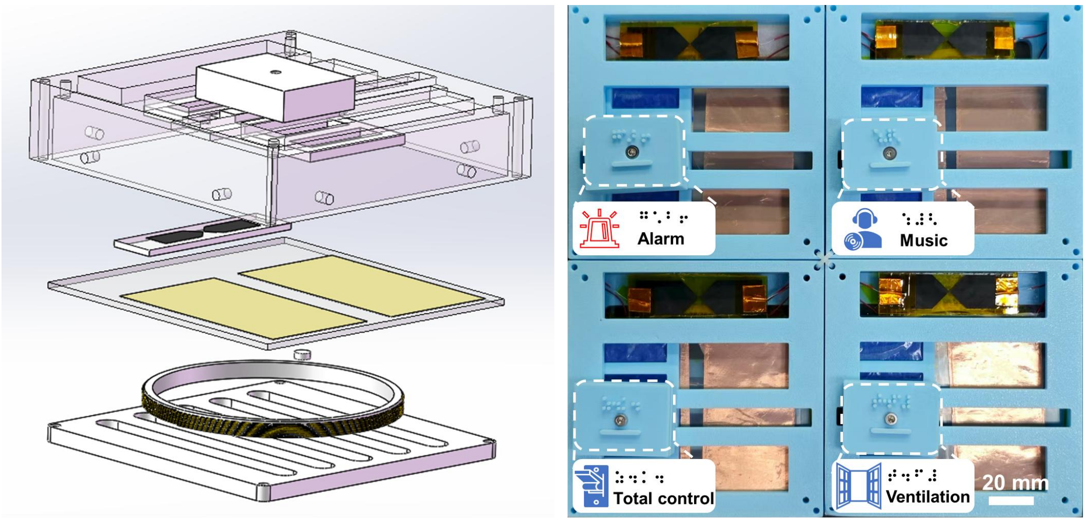
Supplementary Figure 1. Discharge phenomena and influencing factors. (A) Optical image of the tip electrode; the inset is an optical image of the spark generated by the triboelectric discharge; (B) The influence of laser energy density on discharge performance.



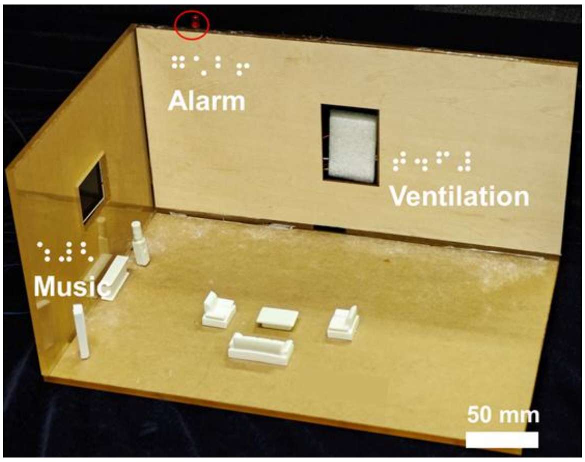
Supplementary Figure 2. Testing of maximum transmission distance, rotation degree and interference. (A) Optical image depicting a transmission distance of 5 meters; (B) Assessment of transmission interference with an operational device; (C) Evaluation of transmission interference in the presence of a strong magnet. (D) The relationship between the received signal's voltage and the receiver coil's rotation degree.



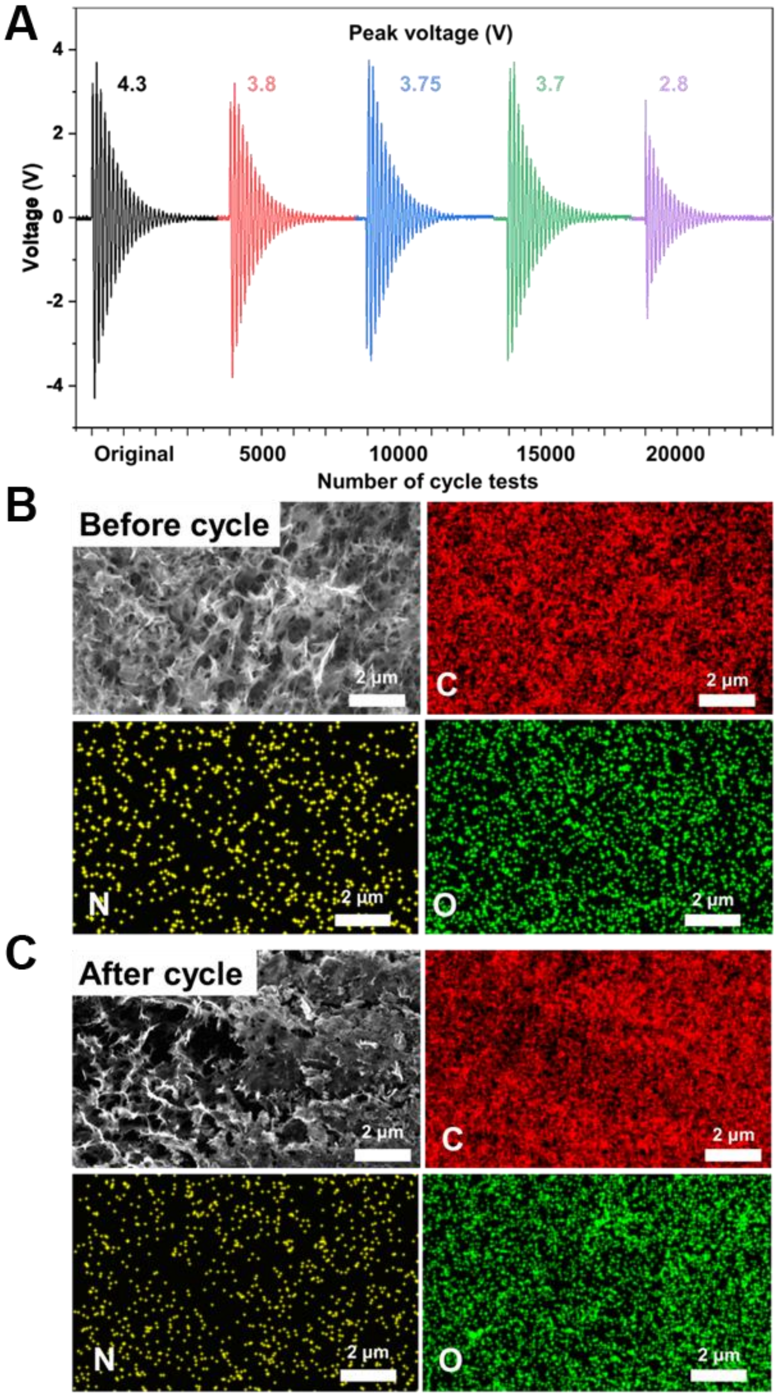
Supplementary Figure 3. Time-domain and frequency-domain responses under dust conditions.



Supplementary Figure 4. Schematic and optical image of multiple SWSS units.



Supplementary Figure 5. Optical image of a reduced-scale model simulating a smart home.



Supplementary Figure 6. Cyclic stability test of SWSS systems. (A) Cyclic durability testing of SWSS systems; (B) EDS test results before the cycle of the tip electrode; and (C) EDS test results after the cycle of the tip electrode.

Supplementary Table 1. The comparison of the graphene-based SWSS with existing wireless sensing

Reference	Electrode manufacturing process	Signal strength (@distance)	Electrode material
[1]	scalpel cutting	≈1 V (50 cm)	Cu
[2]	Electron beam evaporation	≈1 V (30 cm)	Cr/Cu
[3]	Attached	4.26 V (20 cm)	aluminum foil
[4]	Attached	≈0.1 V (8 cm)	Cu
[5]	Attached	0.8 V (20 cm)	Copper foils
[6]	UV lithography	≈1.5 V (50 cm)	Au
[7]	laser cutter	≈2 V (20 cm)	Copper foil
This work	Laser induced graphene	17.5 V (20 cm)	Graphene

Supplementary Table 2. Comparison of the SWSS with similar self-powered wireless sensor systems

Reference	**Wireless transmission method**	**Transmission distance (m)**	**Energy requirement**
[8]	Breakdown discharge	0.15	Contact-Separation TENG
[4]	Breakdown discharge	0.1	Contact-Separation TENG
[9]	Breakdown discharge	5	Contact-Separation TENG
[1]	Breakdown discharge	12	3.7 V Lithium-ion battery
[7]	Breakdown discharge	4	Freestanding triboelectric layer mode
This work	Breakdown discharge	5	Freestanding triboelectric layer mode

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