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## **Supporting Information**

## Conformal van der Waals Graphene Coating Enabled High-Performance Piezo-Ionic Sensor for Spatial, Gesture, and Object Recognition

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**Figure S1**. Schematic of testing the signal outputs of the strain sensor with different bending variations.



**Figure S2.** The voltage output of single electrode mode connecting to various positions at a 50% bending variation.



**Figure S3**. Sheet resistance change of the vdWGRNS with the loading weight of graphene nanosheets. Insert figure shows the sheet resistance of the vdWGR when the accumulated graphene nanosheets exceed 30 mg/m<sup>2</sup>.



Figure S4. Photographs of the vdWGRN under a series bend.



**Figure S5.** Electrical resistance of the vdWGR electrode under 50% bending variation for 10,000 times.



**Figure S6.** SEM images of the vdWGRNS before (left) and after (right) 10,000 times bending at 50% bending variation.



Figure S7. SEM image of cross-section view of the vdWGRN.



Figure S8. FTIR spectra of the vdWGR electrode coating at five random positions.



**Figure S9**. Transmittance of the vdWGRN film in mid-infrared wavelength at five random positions.



Figure S10. Voltage output of vdWGRNS under 10% - 80% bending variation.



Figure S11. A voltage signal of vdWGRNS by soft touching at 30N pressure.



## Figure S12. Signal output of the vdWGRNS touching by various objects.



**Figure S13.** Voltage signals of the eight channels of vdWGRNS used for spatial recognition at plain mode.



**Figure S14.** Voltage signals of the eight channels of vdWGRNS used for spatial recognition at touching mode.



**Figure S15.** Voltage signals of the eight channels of vdWGRNS used for spatial recognition at bending mode.