Triboelectric bending sensor based smart glove towards intuitive multi-dimensional human-machine interfaces

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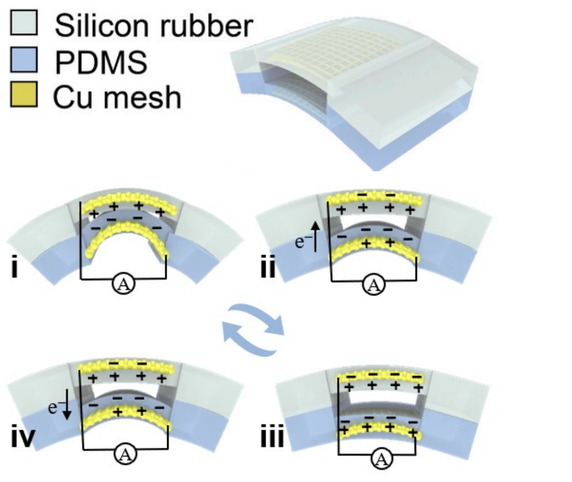
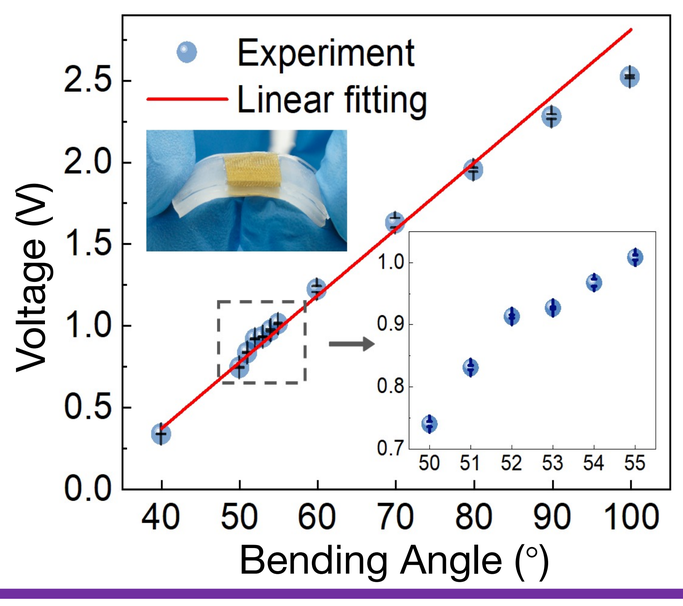
Introduction

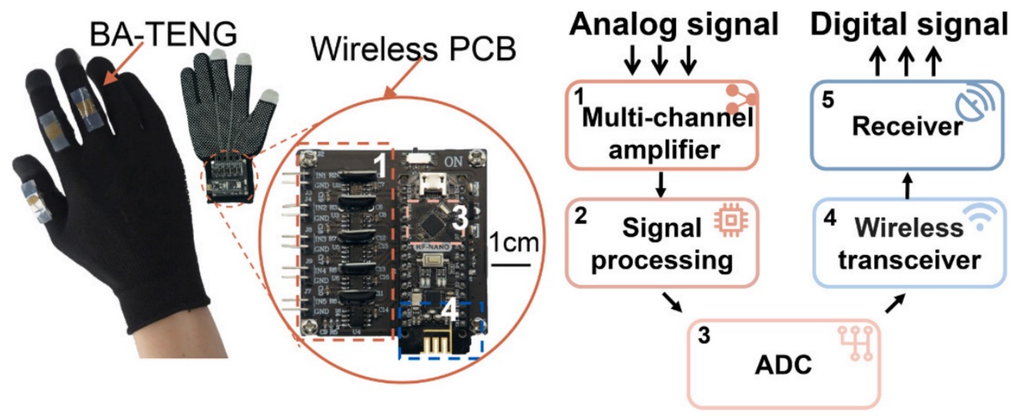
We designed a simple-structured and high-resolution bending angle triboelectric nanogenerator sensor: **BA-TENG** to construct a glove-based multi-dimensional human machine interface(HMI). With the assistance of a customized PCB, the glove-based HMI exhibits high sensitivity and low crosstalk in real-time multi-channel finger motion sensing. By systematically extracting and analyzing the multi-dimensional signal features of the BA-TENG, intuitive multi-dimensional HMIs were realized for smart-home application, advanced robotic control, and a virtual keyboard with user recognition. The classification accuracy of the virtual keyboard for seven users reached 93.1% by leveraging the advanced machine learning technique. The proposed BA-TENG-based smart glove reveals its potential for intuitive multi-dimensional HMI, which is promising in diversified areas, including the IoT, assistive technology, and intelligent recognition systems.

Device Design

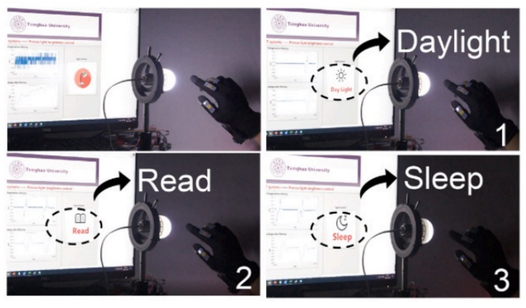


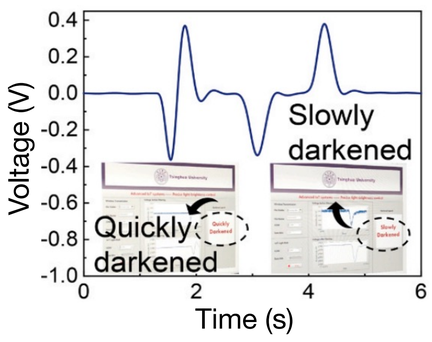


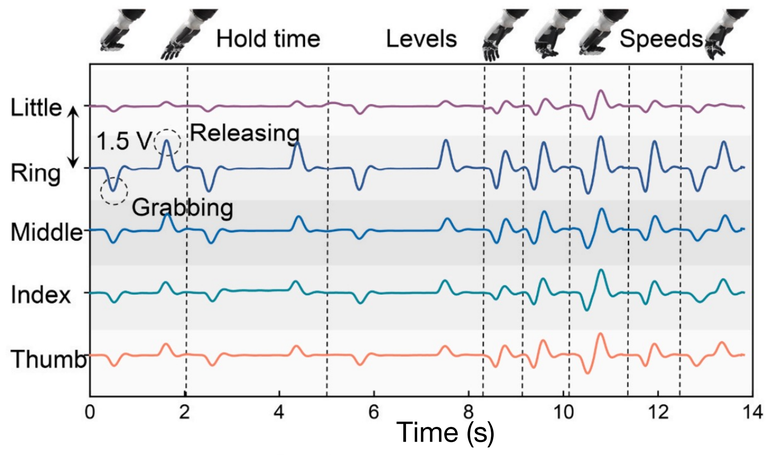
Wireless Data Acquisition

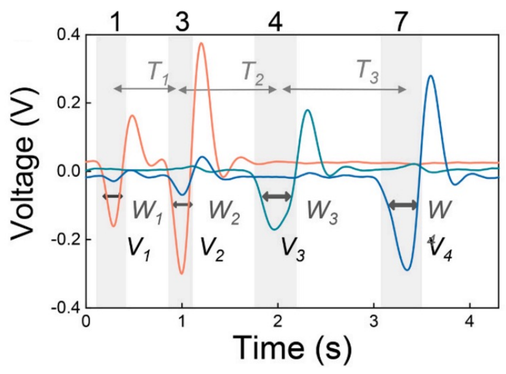


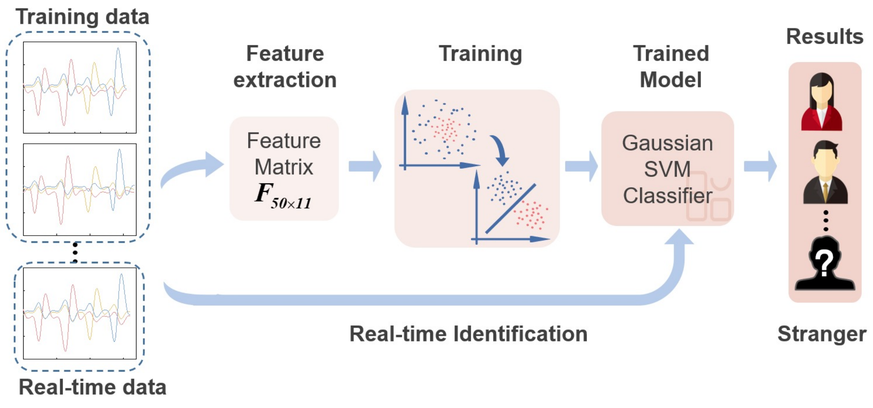
Results

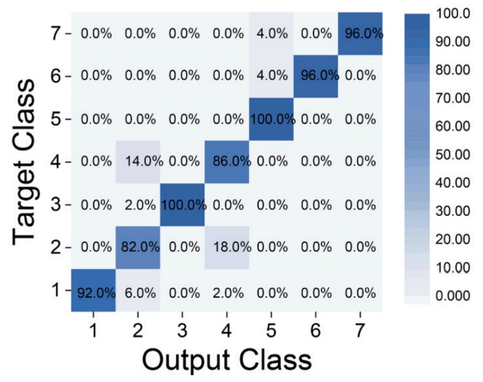


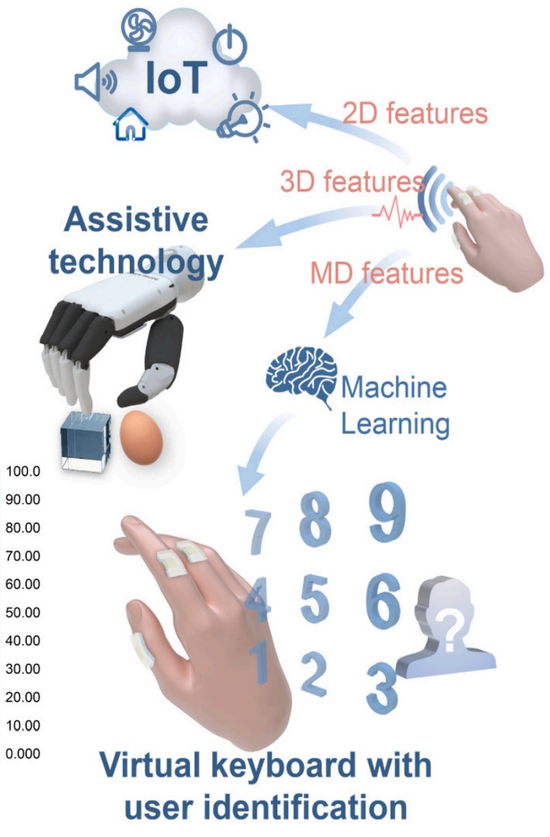












Conclusion

In this work, we designed a simple-structured and high bending angle resolution TENG and extracting multi-dimensional signal features from its triboelectric outputs. Consequently, diversified human-machine interactions, ranging from smart home control to advanced robotic hand control. Moreover, by leveraging the machine learning technique, a virtual keyboard with user identification is achieved by extracting keystroke dynamics from multi-dimensional signal features. Benefit from the minimalist design, the proposed glove-based multi-dimensional HMIs can be readily produced on a large scale with low cost and easy fabrication. This work exhibits the applications of the proposed HMIs for the intelligent IoT, assistive technology, intelligent recognition systems, and more application areas with intuitive and immersive experiences.

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