Self-powered wireless sensing fibers for new wearable technology

The article utilizes the friction electromagnetic induction coupling mechanism to design a single fiber

Design and principle of Fibre-WBAN. (a) Current von Neumann architecture textile-integrated body sensor networks. (b) Our single-fibre-enabled, self-powered wireless sensor network (Fibre-WBAN). (c) Structure and equivalent circuit of Fibre-WBAN. (d) The

FAYETTEVILLE, GA, UNITED STATES, April 15, 2025 /EINPresswire.com/ -- The article utilizes the friction electromagnetic induction coupling mechanism to design a single fiber based Fibre-WBAN it converts the mechanical energy generated by the human body movement into electrical signals and uses the fiber coils to convert the low-frequency time-domain signals into high-frequency frequency-domain signals (40 MHz) for wireless data transmission.

With the rapid development of the Internet of Things (IoT) and smart devices, wearable technology is becoming an important part of people's lives. In particular, wireless body area networks (WBANs) have the capability to monitor the physiological signals of the human body in real time through wireless sensors, providing powerful support for health management, disease prevention and rehabilitation.

Most of the existing wearable devices, however, rely on traditional silicon-based processors and modular electronic components. While these components may be powerful, they pose a number of problems, including rigid structure of the silicon-based processors and electronic components being difficult to be perfectly integrated with soft clothing, especially when worn for a long period of time. Furthermore, these devices usually require external power supply, and the frequent charging of batteries not only increases the cost of use, but also limits the duration of the devices.

To that end, a team of researchers from Donghua University in Shanghai and ETH Zurich proposed a fabric-based wireless sensing network composed of only a single fiber. “We focusedon the mechanism by which the fiber achieves the three functions of energy generation, signal sensing, and wireless transmission, and design a self-powered, chipless wireless smart clothing system based on Fibre-WBAN,” shares co-corresponding author Hongzhi Wang.

The system can be used as an extension of an existing smartwatch with a wireless fabric keyboard to control the game “Snake”, and fiber-WBAN can be directly embroidered on clothing to combine with human movement postures to build a wireless sensing human network to realize gesture recognition. The fiber-WBAN can also perform quantitative signal sensing and sweat monitoring by responding to sodium and chloride ion concentrations in simulated sweat.

“Our results show the potential of using clothing to engineer electromagnetic propagation around the body and provide a starting point for translating concepts of wearable electronics onto a textile platform for wireless sensing, signal processing and energy transfer,” adds Wang.

References
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Lucy Wang
BioDesign Research
email us here