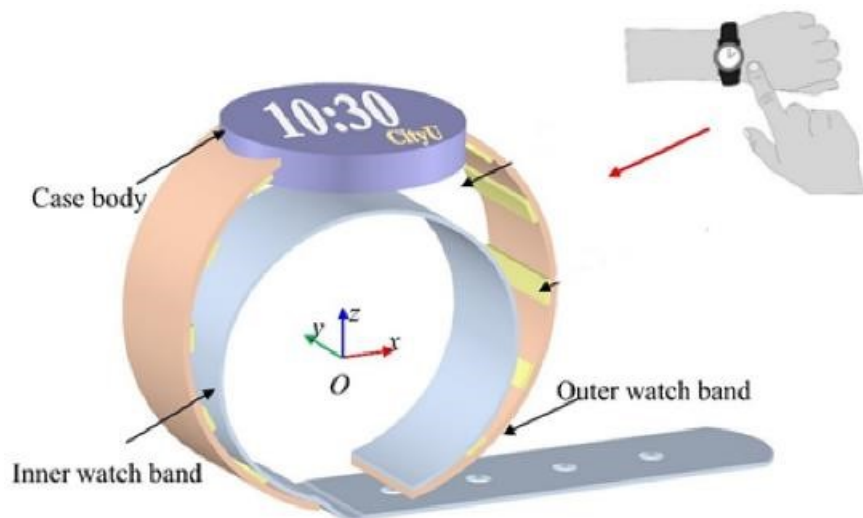


# High-performance Piezoelectric Energy Harvesters for Self-powered Smart Wearables

## Energy & Environment

Energy Conservation/Generation/Management/Storage (Battery)



### IP Status

Patent granted



Technology Readiness  
Level (TRL) ?

4

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## Opportunity

Wearable devices such as smartwatches and activity trackers are changing our lifestyle towards a more convenient and healthier way. Along with the widespread market adoption of wearable devices, problems of the power source - battery becomes increasingly distinct. Batteries have limited lifespans and require frequent recharging. End-of-life battery disposal also poses severe environmental problems. Energy harvesting technology, which enables to harness energy from human daily activities and convert the wasted energy to electricity, is an alternative to batteries. Presently, seeking a breakthrough on high-power density of energy harvesting technology is also a challenge for the further development of self-charging battery-powered wearable electronic devices.

## Technology

The present invention is a unique two-layer band design of energy harvesters for wearable devices based on the piezoelectric effect to generate electricity. The invented structure design is composed of a case, an inner band and an outer band with several piezoelectric elements. The inner band is used to tighten on the wrist, while the outer band is used to support the case and adhere the piezoelectric elements. These two bands connect with each other at two ends. Since the outer band is made of relatively stiff material to bear the weight of the case, the relative motion of the wrist to the case transmits the kinetic energy through the piezoelectric elements to generate electricity. With the power management circuit, the generator can efficiently output and store energy during walking, running, jogging, or hand tapping, etc.



## Advantages

- The invented design of energy harvester brings few changes to the structure of wearable devices and has no side effect on the functions of the devices and user experience.
- The brand-new architecture operates in two modes: i) capture the kinetic energy caused by the inertial effect from gravity and the arm motions during human daily activities; ii) capture the impact energy when a hand strikes the case deliberately.
- The unique two-layer energy harvester shows the maximum output power of 15.41mW when hand tapping and is capable of continuously powering a watch or a screen when walking or hand tapping.
- It has the advantages of relative high-power, reliability, small scale, light weight and low cost.

## Applications

- Wide range of applications that are able to harvest energy by tiny movement or motion is appropriate. They include, but not limit to, Consumer Electronics, Wearable Devices, Medical devices, Smart Vehicles, Internet of Things, etc.
- At initial stage, Smartwatch or Activity Tracker is one of the implementations for which the prototype has been designed. Further potential applications are seeking for collaborative development.

