

TECH OFFER

Human Motion Energy Harvester



KEY INFORMATION

TECHNOLOGY CATEGORY:

Sustainability - Sustainable Living

Electronics - Power Management

Energy - Battery & SuperCapacitor

Energy - Sensor, Network, Power Conversion, Power

Quality & Energy Management

TECHNOLOGY READINESS LEVEL (TRL): **TRL5**

COUNTRY: **SINGAPORE**

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OVERVIEW

There is a proliferation of health-tech wearables in recent years as the healthcare paradigm shifts from discrete monitoring in a hospital to continuous monitoring at one's convenience. However, regular change of batteries and power outlet charging are often the pain points of using these wearables. Moreover, electrical charging points may not be readily available, especially when the user is in an outdoor environment for prolonged periods e.g. field trips that stretch for a few days. For these wearable devices to be powered for uninterrupted usage, there is a need for a constant source of external energy supply.

Ambient energy can be harvested from the body's activities and serve as a reliable external energy source for wearables and portable electronic devices. As this energy source is readily available, energy sustainability can be achieved for the electronics and sensors in wearables and portable devices. However, it remains a technological challenge to develop such energy-harvesting

devices.

This technology offer is a 2-D non-resonant energy harvesting method using hybrid energy harvesting mechanisms that can harvest energy from body movements. It can also be customised to harvest wave or wind energy, etc.

The technology owner is keen to do R&D collaboration, technology licensing and test-bedding with application developers intending to use motion energy harvesting solution to power devices.

TECHNOLOGY FEATURES & SPECIFICATIONS

The technology offer is a hybrid energy harvester that has a unique design configuration. It can overcome the following challenges of existing technology:

- Low, irregular frequency and amplitude generated by body movement, together with the limitation of parasitic damping and harvesting mechanism, often restrict the average output power of an energy harvester to a few microwatts, which is only sufficient to power up devices/wearables with ultra-low power applications.
- Kinetic motion harvesters are typically designed to harvest energy generated by motion in a specific plane of movement. However, human body movements are not constrained to any fixed planes. Thus, the energy harvested may not have reached optimal levels.

The energy harvester, which is of 6cm (L) x 6cm (B) x 4.5 cm (H), is able to generate a power density of $4.8\mu\text{W}/\text{cm}^3$ at acceleration of 1g and frequency of 4Hz. It can be resized and scaled-up according to the application with customisable component selection.

POTENTIAL APPLICATIONS

Besides harnessing energy from human body motion to power wearables and portable electronics, the energy harvester could also be customised for the following applications to harness:

- Blue energy by placing the energy harvester on a mass of water body to power offshore sensors used for monitoring environmental pollution and natural disaster etc.
- Ambient energy e.g. wind, to power wireless IoT sensor networks in remote areas, removing the need for regular battery replacement.
- Kinetic energy from the movement of non-living objects e.g. vehicle or roped elevator

UNIQUE VALUE PROPOSITION

This technology offer has the following advantages compared to existing energy harvesters in the market:

- A hybrid combination of electromagnetic and triboelectric energy harvesting mechanisms allows for more energy to be harvested simultaneously from the same body movements.
- Increased dimensions of mass movements allow more energy to be tapped from different types of body movements.
- The design functions at a low-frequency regime (<10Hz) in non-resonant mode to fully harness the energy from human motion.
- Integrated energy storage and power management circuit allow energy harvested to be stored and managed, thus providing a complete package for product commercialisation.

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