Kinetic Battery Chargers Get a Boost

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New technology to capture the kinetic energy of our everyday movements, such as walking, and to convert it into electrical energy has come a step closer thanks to research to be published in the International Journal Biomechatronics and Biomedical Robotics.

Researchers have for many years attempted to harvest energy from our everyday movements to allow us to trickle charge electronic devices while we are walking without the need for expensive and cumbersome gadgets such as solar panels or hand-cranked chargers. Lightweight devices are limited in the voltage that they can produce from our low-frequency movements to a few millivolts. However, this is not sufficient to drive electrons through a semiconductor diode so that a direct current can be tapped off and used to charge a device, even a low-power medical implant, for instance.

Now, Jiayang Song and Kean Aw of The University of Auckland, New Zealand, have built an energy harvester that consists of a snake-shapes strip of silicone, polydimethylsiloxane, this acts as a flexible cantilever that bends back and forth with body movements. The cantilever is attached to a conducting metal coil with a strong neodymium, NdFeB, magnet inside, all enclosed in a polymer casing. When a conductor moves through a magnetic field a current is induced in the conductor. This has been the basis of electrical generation in power stations, dynamos and other such systems since the discovery of the effect in the nineteenth century. Using a powerful magnet and a conducting coil with lots of turns means a higher voltage can be produced.

In order to extract the electricity generated, there is a need to include special circuitry that takes only the positive voltage and passes it along to a rechargeable battery. In previous work, this circuitry includes a rectifying diode that allows current to flow in one positive direction only and blocks the reverse, negative, current. Unfortunately, the development of kinetic chargers has been stymied by current diode technology that requires a voltage of around 200 millivolts to drive a current.

Song and Aw have now side-stepped this obstacle by using a tiny electrical transformer and a capacitor, which acts like a microelectronic battery. Their charger weighing just a few grams oscillates, wiggling the coil back and forth through the neodymium magnetic field and produces 40 millivolts. The transformer captures this voltage and stores up the charge in the capacitor in fractions of a second. Once the capacitor is full it discharges sending a positive pulse to the rechargeable battery, thus acting as its own rectifier.

The team concedes that this is just the first step towards a viable trickle charger that could be used to keep medical devices, monitors and sensors trickle charged

while a person goes about their normal lives without the need for access to a power supply. The system might be even more useful if it were embedded in an implanted medical device to prolong battery life without the need for repeated surgical intervention to replace a discharged battery. This could be a boon for children requiring a future generation of implanted, electronic diagnostic and therapeutic units.

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