Backpack straps harvest energy to power electronics
13 September 2007, By Lisa Zyga

The group’s intentions in designing the energy harvesting backpack were to make a device that was transparent to the user by not interfering with the user’s flexibility or endurance, as well as providing enough energy to reduce the need for carrying heavy batteries to power portable electronics.

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The backpack uses straps made of polyvinylidene fluoride (PVDF), a strong, flexible material that feels very similar to nylon. But unlike nylon, PVDF is piezoelectric, meaning that an applied stress generates an electrical charge.

When carrying a 100-pound load—a typical amount for a solider’s pack—and walking at 2-3 mph, simulations showed that the straps could generate 45.6 mW of power. The researchers said that this power output could either be used to power small electronics, or be accumulated over the duration of an excursion to be used as a weightless supplemental energy source instead of carrying extra batteries.

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The piezoelectric backpack straps are the latest innovation in the area of “energy harvesting,” where otherwise-wasted, ambient energy is converted into electrical energy to prolong the life of electronics. Mechanical engineers Jonathan Granstrom and Joel Feenstra from Michigan Technological University, Henry Sodano from Arizona State University, and Kevin Farinholt from NanoSonic, Inc., have published their results in a recent issue of Smart Materials and Structures.
straps was finding an extremely robust and durable electrode, since typical electrodes cannot tolerate the high levels of strain imposed by the straps. The researchers teamed up with a company in Blacksburg, Virginia called NanoSonic, Inc., that provided a self-assembled nanocomposite material called “Metal Rubber™” to tailor an advanced electrode. Using nanotechnology to control its macroscopic properties, the researchers fabricated a 100-nm-thick electrode that could undergo strains of 1000% while maintaining conductivity, and then return to its original shape when released.

The researchers hope that additional energy harvesting systems can be also be seamlessly integrated into a user’s normal gear, perhaps based on the piezoelectric backpack straps.


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