Backpack generates a powerful punch

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A backpack that generates electricity as its wearer strolls along has been developed by experts in human locomotion in the US.

By harnessing the loping up-and-down motion of our hips as we walk, the backpack’s freely-moving load bounces up and down, generating up to 7 watts. That is more than enough to power cellphones with power-draining functions like colour widescreens or Wi-Fi and GPS connections.

The developers hope their suspended-load backpack will be a particular boon for troops, field scientists, explorers and disaster relief workers in remote locations.

The generator has been developed by Larry Rome and his colleagues at the University of Pennsylvania, US, with funding from the US Office of Naval Research. Their aim was to relieve soldiers already carrying 36-kilogram backpacks of the need to carry many spare batteries to power their GPS, communications and night-vision devices.

"The extra weight [of the batteries] compromises the amount of food, medicine and armament they can carry," Rome explains.

Upside-down pendulum

An earlier answer to this was the "heel strike" generator - a piezoelectric crystal-based device in a boot heel that generates a battery-charging current when crushed by the wearer’s weight on every footstep. But these gadgets only produce power in the region of 10 to 20 milliwatts. A basic cellphone uses between 1 and 2 watts.

So Rome’s team has worked out how to electrically capture some of the energy a backpack wearer expends when carrying a load.

Their trick is to make use of the fact that a walking person moves like an upside-down pendulum. "One foot is put down and then the body vaults over it, causing the hip to move up and down by 4 to 7 centimetres," he says. And as the hip goes up and down by that vertical distance, so does any load, with the backpack-wearer expending the energy to make it do so.

To retrieve some of that energy as electricity, the team separate the load-carrying sack from the backpack’s frame by mounting it on a spring-loaded plate that is free to move up and down on rail-like rods.

Gaggle of gadgets

The result is that as the wearer walks, their hip motion makes the load oscillate up and down (see a video - mpeg format, 15 MB). To harvest energy from the load's motion, a toothed rod fixed to the
mobile load-plate meshes with a gear wheel on a dynamo fixed to the top of the frame. The load-motion generates a current which can either run a gaggle of gadgets or charge a battery.

In tests of a prototype, six men carried different loads at varying walking speeds. The backpack’s power output increased with walking speed and with the weight of the load in the pack.

Nevertheless, Rome says: "The suspended load backpack is much more comfortable to wear than a normal backpack, because the springs cushion the load and reduce peak forces. So everyone from the military to kids carrying heavy book bags will be benefit from lower forces."

He has now set up a company, Lightning Packs, to commercialise the idea. "We need to reduce the weight and put in a more efficient generator," he says.

Chris Bonington, the British explorer and mountaineer, currently carries solar panels to charge the digital camera batteries he uses in remote places. "Whether this backpack is going to be any good depends on how heavy it is to be useful and how bulky it is. I'd really like to try it though," he told New Scientist.

Trevor Baylis, inventor of the clockwork radio, warns that after events like the London tube bombings, strange-looking backpacks might raise interest at security checks at airports. He abandoned a heel-strike generator he developed in 2001 for this reason: "With the electronics fixed to the side of the shoe, it made the wearer look like a shoe bomber," he says. "Investors didn't want to know."

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