Body Powered Devices

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***Abstract*—With an increasing amount of technological devices used on or with the human body, providing power has become an issue. Instead of coupling devices with Li-ion batteries, we can research and begin harvesting the natural energy our body produces, and effectively wastes, to power the devices we use to monitor ourselves.**

I. Introduction

Energy isn't free, nor is it cheap. Finding sources of energy generally comes with a cost, a potential downside, or fundamental flaw. These issues become compounded the closer we go to the human body. It is acceptable to use Li-ion batteries in a large case by case instance, through phones, and other mobile devices. However, the implementation of Li-ion into the human body seems unnatural. Many portable devices, be it biomedical or not, require power. It would make more sense to power devices that are regularly used on the body, to be powered by the body; through the energy that we produce and waste on a daily basis. This is what many companies such as TEGwear are trying to achieve; providing one source of energy for a wide range of devices that are implemented directly onto the person.

II. Methods

TEGwear, along with many other research and development companies, have successfully found ways to convert the lost heat from the skin into energy devices can use. These devices use thermo-conductivity between the skin, the silicon, and the outside environmental temperatures, to create an entropy gradient used to power small devices. These devices can range from watches, to pacemakers, and even to EKGs. Anything that needs to be powered can be powered from arrays of these conductive devices.

(EKG Powered by thermo-conductivity silicon)

III. Results

The result of converting body heat into electricity is extremely promising. Most non-proprietary lab tests show that this thermo-conductivity method can achieve 0.4% of heat energy and convert it into usable energy. A small number, but enough of these devices have the ability to power small and simple things. As long as is colder in the environment than it is on your skin, these devices will continuously provide an output of power, that can be used to power devices, or charge batteries, without harm to the user. However, these thermo-conductivity devices feel cold to the user, as a result of "sapping" heat away from the surface they are applied to. The more devices in one localized area, the more sensation the user will feel of placing cold metal to their skin.

IV. Discussion

Wearable technologies can become much more feasible when they become powered by our own heat. The application of such technology is also huge, as there is a lot in the world that requires electricity to function. Internal wireless sensors, EKGs, pacemakers, and a whole array of personal electronics can be powered by the body without user intervention or worry. The body is always producing heat, and therefor will always be producing power. TEGwear shows us that by harnessing this energy, not only can device makers save money by skipping out on batteries or their own solutions, but we can make the implementation of these human devices cheaper, easier, and less intrusive. Instead of using wireless conduction to charge an internal battery, the battery can either be skipped, and directly use themo power from the body, or the battery can continuously charge while the user is about their daily business. The world is still very far from these devices becoming mainstream, as the conversion from heat to useable energy is still a feat that we have not fully perfected, but through study and research, just as we've increased the ability to harness solar energy, harnessing heat energy should come just as swift.

References

[1] DOE/Lawrence Berkeley National Laboratory. "Body Heat To Power Cell Phones? Nanowires Enable Recovery Of Waste Heat Energy."*ScienceDaily*, 11 Jan. 2008. Web. 16 Nov. 2013.

[2] Dvorsky, George. "A Chip That Turns Your Body into a Battery." *A Chip That Turns Your Body into a Battery*. Io9, 15 Jan. 2013. Web. 16 Nov. 2013.

[3] Ozcanli, Osman Can. "Turning Body Heat Into Electricity." *Forbes*. Forbes Magazine, 08 June 2010. Web. 16 Nov. 2013.

[4] "TEGwear™ Technology." *TEGwear™ Technology*. Perpetua Power Source, n.d. Web. 16 Nov. 2013.

[5] Wu, D. M., P. L. Hagelstein, P. Chen, K. P. Sinha, and A. Meulenberg. "Quantum-coupled Single-electron Thermal to Electric Conversion Scheme." *Journal of Applied Physics* 106.9 (2009): n. pag. *AIP Scitation*. American Institute of Physics. Web. 16 Nov. 2013.