Batteries Not Included: Moving Toward Long-Term Sustainable Sensing

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ABSTRACT

As a research community, we are always trying to create smaller, cheaper, more mobile, longer-lived sensing devices, to help us collect data that is difficult to collect, while staying within budget. By consuming less energy and supplementing energy stores with harvested energy, it is often possible today—with significant effort—to deploy untethered sensing devices that can last for 1–2 years, without human intervention. Unfortunately, long-term deployments lasting decades are simply not practical, and our dependence on batteries is the single greatest limiting factor.

This talk presents a vision of the future with cheaper, smaller, longer-lived sensors that rely on harvested energy and last for decades with little or no maintenance, and without batteries. Realizing this vision will require us to rethink how we design system components, ranging from power supplies, clocks, task schedulers, and even programming abstractions. Drawing on recent and ongoing work, we will delve into research efforts that are bringing this future closer to reality, and challenges that still stand in our way. Along the way, we will undoubtedly be left with more questions than answers, as we look into the integral role that batteries play in the design of today’s sensor systems, and try to imagine what our systems will eventually look like when designed intentionally without them.

Categories and Subject Descriptors

C.3 [Computer Systems Organization]: Special-purpose and application-based systems

Keywords

energy harvesting, batteries, disruption-tolerant sensing

1. SHORT BIO

Jacob Sorber is an expert in the design low-power embedded systems. His research makes mobile sensors and sensor networks more efficient, robust, deployable, and secure, by

exploring novel systems (both hardware and software), abstractions, and languages. He is an Assistant Professor in Clemson University’s School of Computing. He manages the PERSIST lab at Clemson, and his research in ultra-low power sensing has recently resulted in an NSF CAREER award in 2015 and a Best Paper award at Sensys 2014. He currently teaches Operating Systems at Clemson, hopes to someday create an embedded systems-oriented makerspace, and periodically teaches 7th and 8th graders how to program, wire up sensors, and become future inventors. Before joining the Clemson faculty, he was a postdoctoral researcher at Dartmouth College. He received his M.S. and Ph.D. degrees from the University of Massachusetts Amherst in 2009, and a B.S. degree from Brigham Young University.

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