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# Self-Charging Liquid Droplet Capacitor for Harvesting Ambient Energy

-Potential Applications • Self-powered sensors • Biomedical implants • Internet-of-Things (IoT) devices • Remote monitoring • Portable electronics Benefits and Advantages • Exponential increase in harvested energy – Positive feedback by continuous capacitor switching delivers exponentially more energy than competing methods • Non-mechanical – Diode switches are used instead of failure-prone mechanical switches • Versatile – Higher amounts of harvested energy means a wider range of device power specifications can be met Invention Description Researchers at the University of Hawaii have developed an efficient system for harvesting ambient energy using capacitors featuring freely moving liquid droplets. This conductive liquid droplet, when positioned on a heterogeneous and hydrophobic surface of dielectric materials, forms a parallel-plate capacitor. As the droplet moves along the surface, resulting variations in capacitance give rise to a self-charging mechanism.

This innovation covers the use of passive diodes to switch between capacitors, allowing for geometric growth of harvested energy. In a fabricated device with two self-charging droplet capacitors each with a 450-microliter (μL) water drop, low ambient vibrations produced harvested energy that increased by 100 within 11 cycles. Background Low-power microcontrollers have laid the foundation for the vast expansion of electronic device applications. Pushing this edge further is the promising study of ambient energy harvesting for powering such devices. The practicality of current methods, however, are limited by fixed rates of energy extraction, the types of energies that can be harnessed, and the level of required dedicated storage circuitry. But with the low-level power inherent to ambient sources, how these technologies can be successfully integrated into everyday devices remains a key challenge. Faculty Profile of Professor David T. Ma