

CapHarvester: A Stick-on Capacitive Energy Harvester Using Stray Electric Field from AC Power Lines

CapHarvester aims to replace cumbersome battery power for IoT devices by harnessing the energy from stray electric fields surrounding AC power lines in a home. It avoids the need for an ohmic connection to ground through a capacitive coupling-generated ground reference, allowing for diverse application and placement with minimal safety hazards.

What is the Problem?

Along with the proliferation of IoT devices grows the increasing challenge of powering them. Small scale devices such as these face a fundamental trade-off between the range at which they communicate, and the power they have available. In addition, the cost of constantly replacing batteries and the tedious task of tracking their discharge becomes a cumbersome burden, especially when devices are not within easy reach. Given the relatively low power requirements for IoT devices, it is advantageous to explore other potential sources of power commonly available in a home.

Power lines running on alternating current can radiate such energy in the form of electric fields. However, existing efforts to use this leaking energy face several challenges. Some require a connection to an earth ground, making installation difficult and restricting potential applications. Others require the power line to be actively powering a device, restricting the time it can supply power. There is a clear need for an energy harvesting device that can more effectively capture this type of energy.

What is the Solution?

CapHarvester is a stick-on energy harvester that harnesses the stray electric fields generated around household power lines (110V/230V), without the need to be directly wired to a ground. This is achieved through the use of a capacitive coupling to ground, in place of a direct ohmic connection. These harvesters can be clamped on to any power line regardless of bundling or insulation and can harvest continuously regardless of whether an active load is drawing energy or not.

What is the Competitive Advantage?

-Ease of Use: CapHarvester is a stick-on device needing no modification or connection to ground. This increases both the versatility of application, and the safety of installing and

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Category

Hardware/Other
Selection of Available
Technologies

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maintaining IoT devices.

-Versatility: CapHarvester has been demonstrated in powering 3 real-world applications:
Detecting the appliance state by monitoring the power line to the appliance, measuring ambient temperature and building a zone by zone temperature map, and measuring environmental parameters such as temperature, humidity, and light intensity for indoor farming applications.

-Environmental Impact: By eliminating the need for battery replacements, CapHarvester contributes to reducing electronic waste, making it a more environmentally friendly choice for powering IoT devices.

Patent Information:

References

1. Manoj Gulati, Farshid Salemi Parizi, Eric Whitmire, Sidhant Gupta, Shobha Sundar Ram, Amarjeet Singh, Shwetak N. Patel(2018-09-18) , <https://dl.acm.org/doi/10.1145/3264920>, <https://dl.acm.org/journal/imwut>, 2, 1-20