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RF energy powered wireless temperature sensor for monitoring electrical equipment

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Highlights of the manuscript:

- The design of a small size inverted F antenna (PIFA) that is adaptable for high voltage environment.
- The design of low power, low voltage and quick start transmitter implemented by discrete RF components.
- A low power and high sensitive power management circuit
- Data clashing avoidance strategy

Abstract:

In this work, a radio frequency (RF) energy powered temperature sensor (RFEH) is presented. The aim of this work is to assess whether RFEH is a real alternative to passive surface acoustic wave (SAW) for a high voltage equipment sensing. The RFEH system consists of a dual channel reader and several sensor nodes. The sensor nodes are powered by RF energy transmitted from the reader. The transmitted RF energy is also used as a wake up message for turning on a desired sensor avoiding data clashing. The experiments have successfully demonstrated reliable data transmissions between the sensor nodes and reader. The RF energy harvesting modules are also able to withstand a short burst of electrical discharge at 25kV for 60s. When the sensor nodes are placed on top of the hotplate, the measured temperature is linearly related to the variations of actual temperature with a maximum error of 3.2°C. According to our analysis, RFEH can be considered as a low cost alternative to passive SAW sensor.

Keywords: Energy harvesting, Radio frequency, sensor, wireless, surface acoustic wave, charge pump, Antenna

Introduction:

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