Voltree Power energy harvesting technology enhanced by TI's MSP430™ MCU

"Self-powered systems that can provide 20+ years of uninterrupted operation without maintenance using only energy-harvesting and radiated power sources require a level of efficiency and reliability beyond traditional low-power design. The MSP430, based on TI's ultra-low power technology, has proven to be the ideal solution to enable Voltree Power to cost effectively implement its cutting-edge technology in real-world applications that will significantly impact our daily lives."

–Stella Karavas, CEO, Voltree Power

Company:
Voltree Power

Challenge:
Voltree Power develops innovative solutions to large-scale monitoring problems where systems must be able to operate reliably for decades without access to conventional power supplies. The organization needed to be able to design a robust, low-power sensing network that could collect and transmit data while operating with only the limited and sometimes inconsistent power levels available from bio-energy harvesting and radiated power sources.

Solution:
To maximize available power for data transmission, Voltree Power selected TI's ultra-low power MSP430 microcontroller to serve as the central intelligence of its networked sensor controllers. Voltree Power also used several high-efficiency power converters and TI's SwitcherPro™ power supply design software.

Customer benefit:
TI's MSP430 microcontroller offers compact integration, power efficiency, and the ability to operate reliably when powered by energy harvesting and radiated power technologies. Power supply design was simplified using TI's SwitcherPro software and power converters because of their flexibility and high efficiency (up to 95 percent).

The challenge

Energy harvesting technology tethers non-traditional power sources like metabolic energy from living plants and stray radiated fields such as EMI leakage. Because these sources can be inconsistent, systems must rely upon several sources to ensure enough power is available for wireless sensing networks and automation applications, including environmental and agricultural monitoring, meteorology and climate science, residential and commercial fire detection and prevention, and a host of security applications. Voltree Power needed a microcontroller which could operate on very little power while providing reliable monitoring of power sources and intelligent routing of power to sensor and network components to maximize system efficiency and availability.

The application

Voltree Power is using TI's MSP430 microcontroller and power converter technology in its different mesh sensor network nodes to enable the collection and transmission of sensor data from remote or difficult to reach areas where traditional power is not available and/or personnel cannot easily access equipment to perform maintenance or replace batteries.

TI's ultra-low power MSP430 microcontroller serves as the brain center for each sensor network node, with the added benefit of integrated Flash and SRAM to reduce total chip count for the system. TI's power converters serve as an efficient and reliable power supply for the entire system. The programmable nature

of the MSP430 MCU allows Voltree Power to dynamically select different energy-harvesting technologies to be used with each node, depending upon the particular environmental conditions. The MSP430 microcontroller's flexibility also supports multiple sensing capabilities – including relative humidity, air temperature, soil moisture, and wildfire radio alerts – as well as different radio modules to enable node-to-node communications of greater than ¼ mile.

The solution

TI's ultra-low power microcontroller technology provides unique value in its ability to operate efficiently in energy harvesting applications. Supporting five low-power modes and an architecture specifically optimized to extend operating life, the MSP430 microcontroller offers superior performance at ultra-low power levels and ensures reliable operation in harsh environments where maintenance is not economically feasible. Power efficiency is further enhanced with TI's power supply solutions comprised of industry-leading converters and power supply design software. Step-up and step-down converters operating

at an efficiency of up to 95 percent combined with TI's SwitcherPro power supply design software allow reliable and efficient conversion of harvested energy to the levels needed to operate individual sensor nodes for up to 20 years without maintenance.

OEM customer benefits

TI's industry-leading MSP430 architecture provides the performance and power efficiency needed to meet the low cost, compact form factor, and reliability requirements of remote wireless mesh network and automation system applications. Based on TI's extensive expertise in optimizing microcontroller architectures for performance and power, the MSP430 microcontroller, with its numerous low-power operating modes and high level of peripheral and memory integration, delivers a complete, flexible solution for energy harvesting applications.

Voltree Power's self-powered sensor network technology will enable remote monitoring applications from forest fire detection and prediction to border control and agricultural monitoring around the world. Using TI's ultra-low power microcontroller

"Energy harvesting is a breakthrough technology that will spark exciting new applications across industries and around the world," said Adrian Valenzuela, MSP430 product marketing manager at TI. "Applications like sensor mesh networking are only just beginning to scratch the surface in terms of the potential of energy harvesting, and TI will continue to lead the market in developing the innovative, low-power technologies needed to bring these products to reality."

and power converter technology, Voltree Power has been able to create compact, robust, and intelligent monitoring nodes that can operate in any environment by harvesting energy from multiple sources to guarantee system availability over decades of operation without failure or need for maintenance. In addition, with TI's SwitcherPro design application and high-efficiency converters, Voltree Power can maximize power utilization from its energy harvesting technology for every individual application and operating environment.

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