INSTITUTE FOR SENSING AND EMBEDDED NETWORK SYSTEMS ENGINEERING

Division of Research, Florida Atlantic University

Hardware and Software Architecture for Wireless Sensing Systems Under Dynamic Load and Energy Availability

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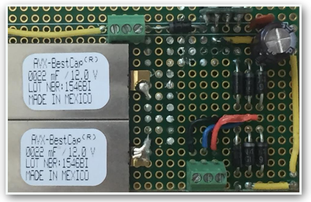
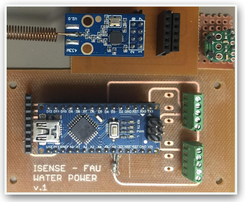
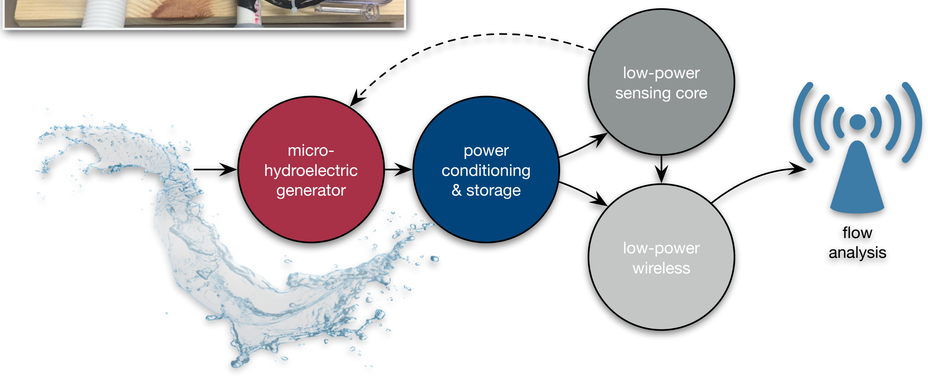
The project stems from work originated by four REU students, focused on the design of a transiently-powered leak detection system that simultaneously monitors and harvests energy from an underground irrigation system.





Key Components

- Miniature, inline turbine
- Magnet, external encoder
- Energy harvesting circuit
- Low-power, 8-bit MCU
- Low-power, 433MHz radio
- Receiving base station
- Flow analysis

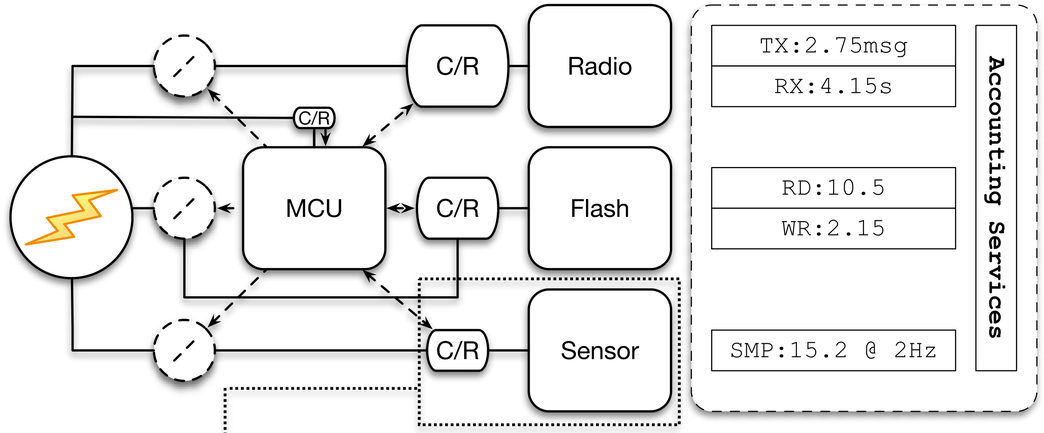


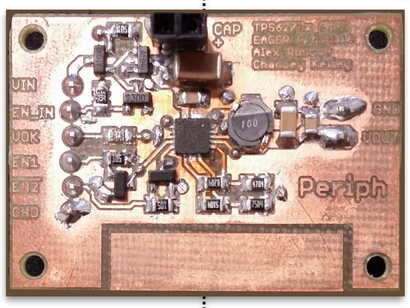
Even at modest flow rates, well below those observed in typical household irrigation systems, continuous operation is possible.

The most interesting outcome, though, was the behavior of the sensing circuit during the transition periods between sufficient and insufficient energy availability.

Hungry peripherals starve leaner peripherals; the phenomenon and root cause were first documented by Hester et al. The concept of *federated energy storage* was described as a solution (*SenSys'15*).

The project is exploring new hardware extensions and supporting operating system services to increase the adaptability and programmability of federated energy storage architectures in the presence of highly dynamic load and energy availability conditions.





Key Features

- Dynamic control of charge and discharge priorities
- Dynamic calculation of service lifetime based on state-of-charge
- Real-valued accounting of available service activations
- Operational testbed