Cooperative Analog Wireless Analog Sensor (AWAS) Networks: A Low-Cost, Low-Frequency Approach to High-Density Applications

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Background

There is a great need for inexpensive, wireless sensor networks. Being able to control and monitor everything around us drives and facilitates our research. Such control is ubiquitous in the modern world with sensors included in many common products that contain electronics. In a world constantly growing more dependent on technology, we are always searching for more cost effective ways of communicating between people, machinery, and the real world.

Purpose

We are developing an analog wireless analog sensor (AWAS) capable of being mass produced with the ability to operate cooperatively in a low-cost radio frequency channel. This device should be small enough to be placed *en masse* and be able to transmit the signal produced by the sensor in the analog domain. Avoiding conversion from analog to digital - which can be much more expensive than using analog parts – is the focus of this work. By avoiding digital conversion we are also avoiding losses in signal fidelity suffered due to quantization errors.

Design/Method

The actual signal we will be sending should be assumed to be steady or slowly varying which is valid for various types of sensors: temperature, power, radiation, acoustic, etc. The data pulse will contain a training voltage to probe the communication channel, the actual sensor information, and an individual ID voltage for each unique sensor. The bandwidth of the signals will be small due to the constant nature of the proposed communication protocol and obviate the need for a medium access controller.

Results

As mentioned earlier the measured values will change very slowly with respect to time and therefore the transmitted messages should contain only a single tone and use minuscule bandwidth. We will be looking at factors such as signal to noise ratio (SNR), spectrum efficiency, range, cost, and size compared to a similar digital WSN in hope of constructing a more accurate analog transmitter than an equivalent digital signal while at a lower cost.

Conclusions

Although we are currently only working on research and proof-of-concept results, we could potentially go well beyond that by introducing a practical and useful product to industry and research communities. By creating a low cost alternative to typical wireless sensors, including a potential for equivalent accuracy at a lower cost and greater spatial range, we have a chance to make something important for future applications in wireless sensing.