

## **Experimental Design with Wireless Sensor Networks**

María Gabriela Calle, University of Pittsburgh, Universidad del Norte, mgc8@pitt.edu

Joseph Kabara, University of Pittsburgh, jkabara@pitt.edu

### **Abstract**

When designing experiments for wireless sensor networks, either to test new communication protocols or as educational exercises, the designer must account for the behavior of hardware and physical circuits. Simulations model nodes as ideal computers, however physical implementations of nodes can express some of the same non-ideal quirks of larger computers. Wireless Sensor Networks (WSNs) are becoming an integral part of the networking infrastructure. The research community has created a variety of protocols which mitigate the energy limitations of these devices (Akyildiz et al. 2002). Much of this research relies on simulations and analytical models, because of the difficulty in building a physical network with hundreds or thousands of nodes. Protocols that appear useful in simulations may be very difficult to implement efficiently in hardware. Since the purpose of all protocols is to work in an actual environment, eventually a protocol must be implemented in a physical network, even if this implementation is a small network to test the protocol performance.

Experience implementing protocols for WSNs shows that experimental designs must account for random malfunctions in one or several devices, hardware platform constraints (memory, processor speed, programming languages), less than ideal radio transmission range and their implications in MAC and routing protocols, modulation schemes, data rate and energy consumption. Each of these constraints affects the experimental results (Calle 2006). Accounting for these considerations will result in experiments with less variation in the results.