WISAN 2

Wireless Intelligent Sensor and Actuator Network (WISAN) is a scalable ultra-low-power platform for sensing applications.

Existing sensor networks do not completely satisfy requirements of problems posed by structural health monitoring: the proactive, constant data rate character of the data streams rather than reactive, event-driven data delivery; real-time requirements to bidirectional data flow from sensors and to actuators.

WISAN is designed to address these issues and support massive arrays of heterogeneous sensors with constant data streams. Development of WISAN is funded by New York State Energy Research and Development Authority (NYSERDA) and industry.

Current design is the second generation of the WISAN platform, offering additional capabilities and ready for manufacturing and marketing in various applications.

WISAN offers the following functionality:


WISAN1.1 node vs. WISAN 2 node

1. Low-cost massive data acquisition from arrays of heterogeneous sensors with constant data streams forming a distributed data acquisition system. Providing uninterrupted, steady streams of data is the focus of the network. Other platforms, like Tiny OS, do not have such capabilities.

2. Ultra-low power consumption of a sensor node is achieved through efficient optimization of wireless protocols that minimize the amount of time the transceiver is powered during operation and virtually eliminate collisions, retransmissions and packet loss.

3. Each node in the network keeps precise global time that is continuously updated and kept synchronized on the order of few microseconds. This feature enables "wired-like" behavior, where a data sample is taken at exactly the same moment by all nodes in the network. Again, this feature is not available in Tiny OS and other platforms.
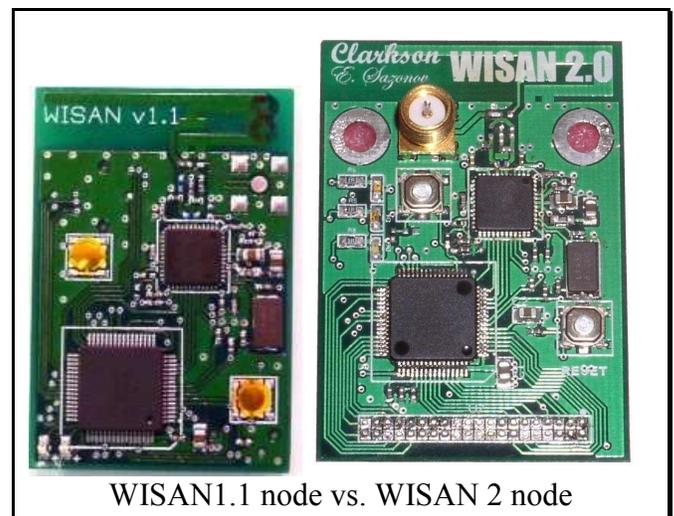
4. Transparent scheduling extension on top of IEEE802.15.4 protocol enable almost 100% efficient bandwidth utilization by eliminating network collisions and providing 3-5 times more bandwidth compared with traditional CSMA-CA. This feature allows either to increase the network size or to increase node throughput by a factor of 3-5.

5. Low latency of the data transmission allows implementation of wireless control loops. Low latency is ensured through the same scheduling protocol.

6. WISAN is fully compatible with IEEE 802.15.4 and can be utilized worldwide in 2.4Ghz ISM frequency band and coexists with WiFi and other devices. The coordinator node self-selects the best channel based on results of energy scans.

7. Sensor node design allows a variety of external extensions on stackable boards. Interface pins include digital IO, analog in and analog out, SPI, I^2C, and serial interface.

WISAN 2 platform offers the following additional capabilities that were added over basic WISAN1.1 design:

- optional micropower 24-bit ADC with programmable gain, offset and antialiasing circuitry, adding capability for easy interfacing of differential sensors

- micropower on-board voltage regulator allows a wider range of voltages, maximizing utilization of battery capacity and accommodating various power sources

- 1Mb flash memory for on-board storage

- 32Khz oscillator for real time clock and low-power modes

Rear view of WISAN 2 node

- a solderable connector for reliable sensor board connection

- additional LED, mounting holes, reset and user buttons
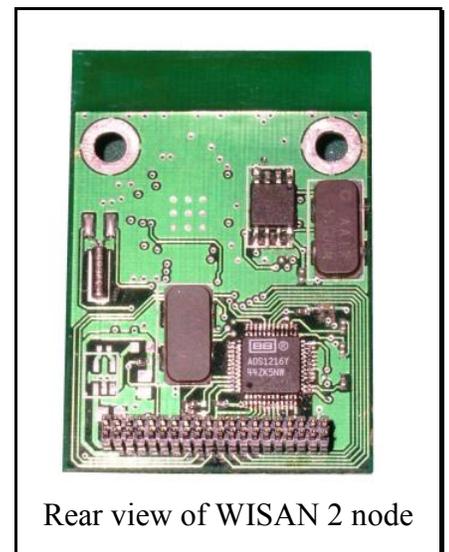
Hardware and software components of the WISAN 2 platform enable its utilization in a variety of applications, including monitoring of transportation infrastructure.