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IEEE 1451 – A Standard for Smart Sensors
"finally, sensors are Plug & Play"

Introduction

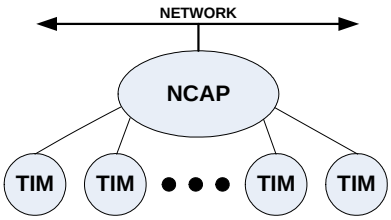
The uses for digital communication and networked configurations to connect sensors and actuators are increasing. The trend is towards distributed control with intelligent sensing architectures. Critical to rapid deployment and ease of installation of intelligent sensing networks is wireless sensor communications. The IEEE 1451 standard addresses these trends.

What is IEEE 1451?

- An industry-wide open standard for Intelligent Sensors (Smart Sensors)
  - Develop network-independent and vendor-independent transducer interfaces
  - Support a general model for transducer data, control, timing, configuration and calibration
- Specifies physical and functional interfaces between sensors/actuators and instruments/ microprocessors/networks
- Specifies analog, digital and wireless interfaces to provide ease in connecting sensors and actuators either by wireline or wireless methods
- Provides a self-describing sensor via the Transducer Electronic Data Sheet (TEDS) that contains manufacture-related data
- Allows sensors to be installed, upgraded, replaced and/or moved with minimum effort
- Eliminates manual entering of data and system configuration steps which is error prone

What is a Smart Sensor System?

1. Network Capable Application Processor (NCAP) where control and data correction takes place
2. Transducer Interface Module (TIM) (one or more) containing the transducer and data acquisition



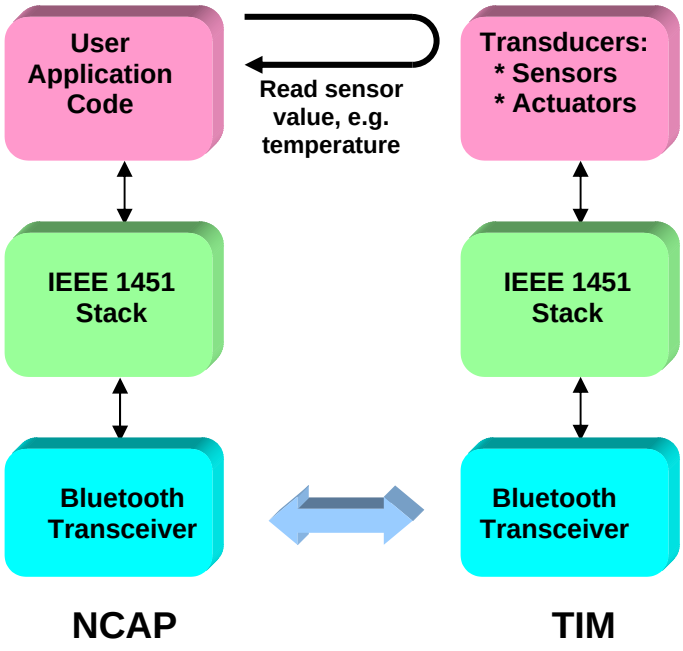
NCAP (Network Capable Application Processor)

- Communications
- Interface Control
- Message Routing
- TIM Discovery and Control
- Data Correction
- Interpretation of TEDS Data
- Message Encoding and Decoding

TIM (Transducer Interface Module)

- Analog Signal Conditioning
- Triggering
- Analog to Digital Conversion
- Command Processing
- TEDS Storage
- Data Transfer
- Communications

Example Operation:



Benefits of the IEEE 1451 Standard

- A set of standardized transducer interfaces will lower the cost of designing smart sensors and actuators (provides a standard transducer model for control and data)
- Smart sensors can provide measurements in physical units with significant digits
- Smart sensor systems are easier to install, maintain, modify and upgrade
- Smart sensors are simple to use – "Plug & Play" makes replacement easy and quick

Smart Sensor Systems' IEEE 1451-Compliant Products

Smart Sensor Systems provides products and services to help you make your sensors wireless and IEEE 1451 compliant. We provide development kits, consulting or contract custom design to make your transducers (sensors and actuators) wireless.

**** Bluetooth Sensor Development Kit

The Bluetooth Sensor Development Kit provides a modular design for the flexibility needed to accommodate many different kinds of transducers. PC/104 standard modular printed circuit board stacking technology is used to ensure maximum flexibility. The Development Kit includes three printed circuit boards (cards) that are stacked on top of each other. Also included is an extender board.

Radio Card – The Radio Card contains the TIM wireless Bluetooth transceiver chip. The Radio Card also contains a 3.3 VDC voltage regulator and a 5 VDC voltage regulator.
Processor Card – The Processor Card contains a 32-bit microprocessor and contains a JTAG (Joint Test Action Group) 20-pin connector to permit software downloading and debugging.
Interface Card – The Interface Card contains a variety of interface circuitry such as signal conditioning, a 20-bit A/D converter, actuator drivers and the like. This card also provides space to breadboard sensor or actuator circuitry and an Extender Board is provided to aid in this development.
Extender Board – The Extender Board is a 16-bit board that allows the Interface Card to be placed side-by-side the PC/104 stack for access to the breadboard circuitry and sensor during development.

**** Sensor Application Software Development Kit

The Sensor Application Software Development Kit supports a full IEEE-1451.0 Network Capable Application Processor (NCAP) functionality on any PC running Windows XP. This software allows software developers running Microsoft Visual Studio or National Instruments' LabVIEW, control and access to smart sensors that implement the IEEE-1451 standards. In addition to controlling smart sensors, the Virtual NCAP will include a sensor explorer application that will automatically discover sensors, show characteristics of each sensor and allow simple control and reading of the sensors without programming. The product also includes a web server interface that will present sensor data over a network (Windows XP Professional required).

Supported Sensor Interfaces:	RS-232, 802.11a/b/g and Bluetooth
Supported Development Environments:	Microsoft Visual Studio.NET 2003 and later
	National Instruments LabVIEW 7.0 and later