Virtual Sensor Test Instrumentation

This technology has application in wireless RFID systems.

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Virtual Sensor Test Instrumentation is based on the concept of smart sensor technology for testing with intelligence needed to perform self-diagnosis of health, and to participate in a hierarchy of health determination at sensor, process, and system levels. A virtual sensor test instrumentation consists of five elements: (1) a common sensor interface, (2) microprocessor, (3) wireless interface, (4) signal conditioning and ADC/DAC (analog-to-digital conversion/digital-to-analog conversion), and (5) onboard EEPROM (electrically erasable programmable read-only memory) for metadata storage and executable software to create powerful, scalable, reconfigurable, and reliable embedded and distributed test instruments. In order to maximize the efficient data conversion through the smart sensor node, plug-and-play functionality is required to interface with traditional sensors to enhance their identity and capabilities for data processing and communications.

Virtual sensor test instrumentation can be accessible wirelessly via a Network Capable Application Processor (NCAP) or a Smart Transducer Interface Module (STIM) that may be managed under real-time rule engines for mission-critical applications.

The transducer senses the physical quantity being measured and converts it into an electrical signal. The signal is fed to an A/D converter, and is ready for use by the processor to execute functional transformation based on the sensor characteristics stored in a Transducer Electronic Data Sheet (TEDS). Virtual sensor test instrumentation is built upon an open-system architecture with standardized protocol modules/stacks to interface with industry standards and commonly used software. One major benefit for deploying the virtual sensor test instrumentation is the ability, through a plug-and-play common interface, to convert raw sensor data in either analog or digital form, to an IEEE 1451 standard-based smart sensor, which has instructions to program sensors for a wide variety of functions. The sensor data is processed in a distributed fashion across the network, providing a large pool of resources in real time to meet stringent latency requirements. Advantages of deploying the virtual sensor test instrumentation include:

- Simplification of troubleshooting through HTML/XML-based Health Monitoring that allows the user to verify all sensors via a graphic user interface.
- Cost reduction for set-up and tear-down through sensor auto detection.
- Elimination of recalibration when replacing sensors. The data acquisition system can recalibrate itself through TEDS.
- Elimination of large lengths of analog wiring through a radio frequency module.
- Reduction of installation, maintenance, and upgrade costs of measurement and control systems through Web-based TEDS server.
- Increased opportunity to add intelligence to sensors through embedded EEPROM.

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Fig. 2. LOLA Laser 1 S/C Level Boresite Alignment Test Results: (a) X-Axis, (b) Y-Axis.