Autonomous Intelligent Sensor for Tracking Systems (AISTS)

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Remote Sensing & Monitoring now Possible in Traditionally Inaccessible Metal Enclosed Spaces!

The AISTS is a comprehensive smart sensor that was built to access, upload, and download data from areas that are not traditionally accessible due to metal enclosures or barriers. This technology utilizes advanced sensing schemes that are customizable for applications that have a need to monitor, analyze, or maintain assets with such constraints. The non-intrusive AISTS has through-metal data and energy transferal capability by ultrasound, but it can also be easily setup with conventional powering and communication electronics. The device can last between charges for 1 month (active) up to 1 year (sleep) with a miniature 450 mAh rechargeable battery.

AISTS Block Diagram and Main Board Picture

Optimized Size, Weight, and Power (SWaP) with Intelligent Processing

This ultra low power, self-sufficient, and advanced smart sensor, designed with optimized SWaP and embedded intelligent algorithms, builds upon an advanced rad-hard microcontroller to accurately measure, detect, log, and report events related to the health, status, or environment of monitored systems. Low power operation (3.3v, 487.94 μA in active mode, 57.02 μA in sleep mode) enables event registration and logging data for extended periods of time to later be downloaded by a host system or mobile device.

Customizable and Flexible Smart Sensor

AISTS' modular design is based on a Main-Board, a small Satellite-Board with customizable transducers, expansion bus (I2C, UART, IrDA, SPI, GPIO, and ADC channels), and a rechargeable battery. The Satellite Board's state-of-the-art vibration sensing suite has a high performance analog 3-axis accelerometer and digital 3-axis accelerometer with features such as impact detection (requires just 144 μW) and activity monitoring. Even if in sleep mode, monitoring is possible since the Main Board's ultra-low power, stand-alone temperature sensor identifies temperature events, while the digital accelerometer monitors impact or shock.
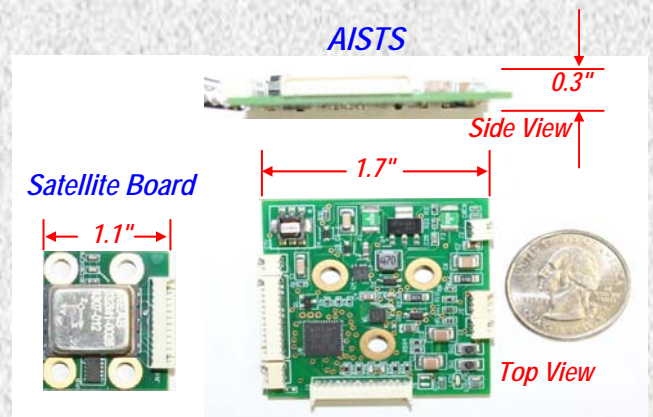
Standardized & Advanced Embedded Features

A custom subset of embedded functions from the IEEE 1451 Standard provides a communication protocol, fault detection awareness by fast notifications, and Transducer Electronic Data Sheet (TEDS) management. Specifications of each unit as well as a unique identification are provided within TEDS. Intelligent health monitoring features such as diagnostics, calibration support, sensor self-diagnosis, among others are all provided within a common software structure.

Operation as a Non-Intrusive and Standalone Smart Sensor with Debriefing Capability

A Hand Held Reader with a standardized communication protocol allows sending commands to and downloading health data logs from the AISTS. RS-232, SPI, and ZigBee are communication interfaces between the Reader and the AISTS. However, for applications that require through wall energy and data transfer, an ultrasound system is used. Communication modules can be customized to many devices such as the ruggedized Trimble Nomad®.

Structural Health Monitoring

Corrosion Monitoring & Thru-Metal Communication

Mobile Hand Held Reader

Applications

- Structural Health Monitoring
- Corrosion Monitoring
- Vibration Analysis
- Condition Based Maintenance
- Container Internal Monitoring
- Weapon Systems Health Monitoring