Sentient Guardian™

Embedded Programmable Instrumentation Controller

TechConnect National Innovation Award

Patent 6,938,177

The Sentient Guardian™ has a comprehensive fully open multi-purpose architecture that does much more than data logging. The Sentient Guardian performs reasoning, baselining, diagnostics, prognostics, messaging and timely intelligent control actions. The Sentient Guardian is designed for embedded data collection and analysis of health states to determine the current maintenance condition of equipment. The electronics may be embedded in a small chassis or mounted in the backshell of MIL-SPEC connectors used in electronic systems and wiring harnesses. The Sentient Guardian can be used in multiple instances in connectors or wiring. Two or more Sentient Guardians can operate separately or in a cooperative network to more completely assess the health status of a total system.

APPLICATIONS

The Sentient Guardian can be used for vehicle health management, test instrumentation, computation of stored complex algorithms, analog processing, electronic waveform signal processing, control, and inspection of the health of wiring harnesses.

SENTIENT GUARDIAN CIRCUIT MODULE

The Sentient Guardian is a single board self-contained circuit module. The circuit architecture includes a powerful 32-bit microprocessor, self-protection, sensor data and signature acquisition, input/output ports, and ports for USB, serial, and Wi-Fi.

Cortex M3 80MHz Processor	GPIO & Analog: 23 I/O (0-3.3 VDC)
FPGA Co-Processor	Power: 4 watt, 5 VDC
SRAM: 64KB	Temp: -40 to +85 degrees Celsius
Flash: 256KB	Analog:
USB 2.0 Full Speed	2x 12-Bit ADC 1x 20 bit ADC
Serial	4x 8 bit DAC
Wi-Fi	4x op amps
SPI	Multiplexors
I2C	1.024V reference

EXECUTION ENGINE

The Sentient Guardian's real time management provides externally programmable processes for user-defined rules. These rules control data collection, fusion, analyses, actions and communication. An optional user-programmable Bayesian Cognitive Inference Calculus engine performs dynamic probabilistic Bayesian model construction for diagnostics, prognostics and control.

PROGRAMMING

The Sentient Guardian can be programmed with-user defined compiled C++ applications or logic switched Bayesian Inference Calculus algorithms. A TCP/IP interface command language is provided for remote programming with a network computer or portable device.

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FUNCTIONS

- Operates from 5-36VDC
- Selectable 23 analog/GPIO
- Live electrical signal analysis
- Diagnosis of faults in wiring and components
- Analog processing and Digital Processing
- Detection of signal and sensor anomalies
- Bayesian Baseline Correlation to recorded data
- WiFi or wired serial, and USB communications
- Messaging on event or in response to remote query

FEATURES INCLUDE:

- Self-tests
- Continuous monitoring and analysis
- Inventory, performance and activity monitoring
- Troubleshooting modes for locating intermittent and other troublesome faults
- Communication with publish/subscribe for remote query response

USAGE:

Sentient Guardians are installed as stand-alone chassis or by plug-in at an existing D38999 wiring connector. Operating instructions are either pre-installed, or installed, reconfigured, or updated after installation by using USB, serial, wireless link, or direct reprogramming of the processor. Remote query, message passing interface, and offload of data and results is by using TCP/IP command structures via USB, wireless or serial connection to Personal Computers or other computer interface. Harness adapters can be configured to interface the Sentient Guardian with any electrical system or harness.

PENDING TRANSITIONS

- Developing application for C-130J and Global Hawk
- Transition pending for Engine Monitoring for Predator/Reaper
- Transition pending for CBM on Fire Scout and Apache

APPLICATIONS INCLUDE

- Networked Cloud Processing
- Demonstrated CBM+ on Marine Corps ground vehicle
- Embedded Prognostic Health Management for most ground and airborne vehicles
- Embedded data acquisition for operational tests and continuous operational evaluation
- Automated training support (embedded training)
- Automated maintenance troubleshooting, support and verification of return to service