technology opportunity

Nanostructure Sensing and Transmission of Gas Data

Wireless Transmission of Data Provided by Nanostructure-based Chemical and Physical Sensors

Using nanostructure sensing, a sensor can receive, analyze, and communicate the results of a chemical or gas presence using wireless transmission.

This system provides one or more sensors for selected chemicals (all using nanostructure sensors with small physical sizes), one or more sensors for physical parameters (e.g. voltage or current), a multiplexer to receive and interleave the measured data stream values from the sensors according to a selected interleaving pattern, and a wireless transmission module to transmit the measured values to a receiver and data analyzer. The overall sensor system consists of a chemical sensor module, a microcontroller-based data acquisition module, a multiplexer and constant current source module, and a wireless communications module. The chemical sensor module is based on the use of an interdigitated electrode (IDE) configuration. In one embodiment, the system has 32 channels of chemical sensing elements, arranged in an IDE configuration, having pure single-wall carbon nanotubes (SWCNTs), polymer-coated SWCNTs, and/or metal nanoclusters or doped SWCNTs. When exposed to a vapor-phase analyte, each sensing element in the array responds uniquely. A reproducible combination of resistances or “smellprint” for each vapor/gas is manifest. The sensor response is measured as a bulk relative resistance change (alternatively, current change or voltage change).

Technology Background

At the center of the data acquisition system is a microcontroller that samples each sensor element through a set of four multiplexers. Each MUX reads signals from a group of eight chemical sensing elements. The LM234A constant current source is used to provide a constant current (100 μA) to each sensing element. The current level is dependent upon the base resistances of different nanostructure sensing materials. Four of these devices (or one device if the sensing materials have similar base resistances) are used to excite each group of eight chemical sensing elements. Conductivity or resistance is measured by supplying a constant current and measuring the corresponding voltage difference across the sensor. Also included in the data system is temperature measurement by using an AD22100K temperature sensor. The microcontroller reads all 32 chemical sensor and temperature values and generates a serial data output that can be connected directly to a wireless serial device server for wireless data transmission, or to an RS-232 serial data output to a PC for data logging.

Each of the individual sensors has its own data reporting cycle, and it is assumed that these reporting cycles are numerically compatible. In the first approach, each of the reporting cycles has the same length Δt, and the four sensors report to the multiplexer in a consecutive interleave pattern.

This innovation is self-contained and portable, and wirelessly transmits measurement data to a PC, using an IEEE802.11a, 802.11b, or 802.15 wireless LAN protocol. The footprint of the invention has a diameter as small as a few centimeters.

Patents

This technology has been patented (U.S. Patent 7,968,054).

Licensing and Partnering Opportunities

This technology is part of NASA's Innovative Partnerships Program, which seeks to transfer technology into and out of NASA to benefit the space program and U.S. industry. NASA invites companies to inquire about licensing possibilities for this technology for commercial applications.

For More Information

If you would like more information about this technology, please contact:

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