IEEE1451 standard in wireless sensor networks using TinyOS message abstractions

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Summary

This poster describes the IEEE1451 message structure of some commands and transactions using the TinyOS basic network abstractions. The network is composed by one base station namely Network Capable Application Processor (NCAP) and several Wireless Transducer interface Modules (WTIMs). The messages are transmitted between the NCAP and each WTIM. We propose the use of the general message structure IEEE1451 with ZigBee and 6loWPAN interfaces using the TinyOS packet protocols to improve the interoperability of heterogeneous smart sensor nodes. Tests are conducted to evaluate the implementation of the IEEE1451 standard and determinate the complexity of the transactions and alternative methods for energy management.

Motivation

We are deploying an environmental WSN, called REALnet, in our campus to monitorize weather parameters including temperature, humidity, solar radiation, wind speed and direction, barometric pressure and rainfall to act on the environment in a more sustainable way. This development permits us to investigate several topics that can be critical barriers to developed WSNs including power consumption, power supply and interoperability.

Results

Tests were carried out with one NCAP and three WTIMs using a Tmote sky platform. We used the message structure for the NCAP request commands shown in Figure 1, where the IEEE1451.0 message is encapsulated within an IEEE1451.5 compliant frame that use:

Node Header: includes a local group identifier (1 byte), address node (2 bytes), and data counter (2 bytes).

Command header: includes a command type header (1 byte), packet identifier header (1 byte), sequence number (2 bytes) and data octets that are the IEEE1451.0 messages.
Cycle Redundancy Check (CRC): detects possible errors in the transmission of the message.

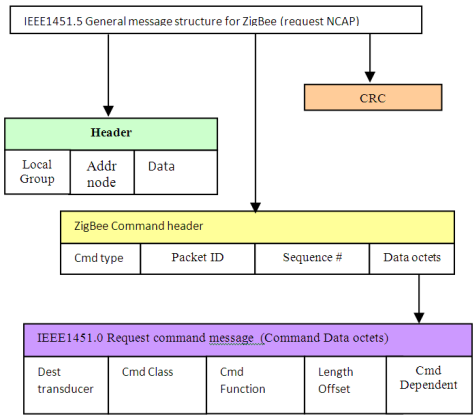

Fig1. IEEE1451 request message structure

Next steps are used to connect the NCAP with WTIMs:

Discover phase: NCAP discovers all WTIMs using the TinyOS active message structure.

Registration phase: NCAP register all WTIMs transducer channels (temperature, humidity, solar radiation, battery voltage, etc).

Transducer Electronic Datasheet (TEDS) query: Command used for read the information related with configuration and calibration. NCAP request information about the mandatory TEDS in each WTIM.

Configuration: NCAP configures the WTIMs and mandatory TEDS.

Data exchange: Data transfer between NCAP and WTIMs to read the weather parameters.

The NCAP node sends IEEE1451 commands and receives data information from WTIM nodes depending on the identification number (ID) in the network. Each WTIM automatically performs all environmental measurements and returns the results to the base station.