Demo Abstract: The DSYS25 Sensor Platform

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ABSTRACT

In this demonstration, a new sensor platform named DSYS25 is presented. The platform has a unique hardware design and runs a customized version of the TinyOS operating system. Transceiver hardware and packaging distinguish the D-Systems platform from other available designs.

Categories and Subject Descriptors

C.3 [Special-purpose and application-based systems]: Real-time and embedded systems.

General Terms

Design, Performance.

Keywords

Wireless Sensor Networks, Platform, Design.

1. INTRODUCTION

DSYS25 is a sensor platform developed as part of the D-Systems project at University College Cork. On the hardware side, the key objective of D-Systems is to produce miniaturized autonomous sensing units that can be easily deployed and maintained in the everyday environment. The target sensing module is a 5mm cube incorporating commercial-off-the-shelf (COTS) microsensors, ICs for signal processing, computation, and wireless communications, and a power source combined together within a highly innovative microelectronics packaging configuration

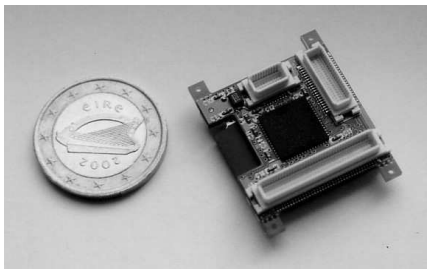
On the software side, the contribution will consist of a power aware operating system for the miniaturized autonomous sensing units that leverages the unique capabilities provided by the hardware.

D-Systems is a joint project of the National Microelectronic Research Center (NMRC) and the Computer Science Department at University College Cork, Ireland. Funding is provided by Enterprise Ireland.

2. SYSTEM DESCRIPTION

The DSYS25 sensor platform is a 25mm x 25mm module suitable to be deployed in applications ranging from traffic management to agriculture. The figure in this page depicts the module alongside an one Euro coin for comparison purposes.

SenSys'04, November 3-5, 2004, Baltimore, Maryland, USA.
ACM 1-58113-879-2/04/0011.



Hardware - The DSYS25 module comprises an Atmel AVR ATMEGA 128 microcontroller and a Nordic nRF2401 Transceiver. Additional functionality, such as sensing, is added by stacking layers to the basic unit.

A stackable connector system make the electrical and mechanical interconnections between layers. The connectors facilitate an 80 pin general purpose bus and a 40 pin bus for configuration and data transfer between layers. The RF transceiver layer also has a 20 pin connector for four low noise analog input channels so as to have the capability of integrating sensitive analog sensors directly to the microcontroller part of this layer.

The chosen transceiver performs communication tasks such as address and CRC computation freeing the microcontroller from these activities. Thus the microcontroller can be either used for other purposes or can be sent to an energy saving sleep mode. The transceiver is also able to transmit data at high data rates (up to 1Mbps). By transmitting faster, the radio can quickly return to a power saving mode and therefore energy consumption is reduced

Software - A specifically tailored version of the TinyOS operation system is used in the D-Systems platform. As a result, the platform can take advantage of a large variety of TinyOS-based applications already existent.

The transceiver hardware has a huge impact on the design of the communication stack within TinyOS. As functionality is shifted towards the transceiver chip, a simpler design of the communication stack is possible. A message can be simply transferred to the transceiver chip and the entire transmission process is handled by the radio. Similarly, incoming messages are also handled by the transceiver, only interrupting the CPU after a successful reception

3. DEMONSTRATION

In the demonstration, several DSYS25 modules will be shown. The units will run a standard, existing TinyOS-based application, which collects sensor readings for an ad-hoc network of module units and displays related information on the screen of a laptop computer.