

## Wireless Design Challenge

### Winners Announcement

There's something about ZigBee technology that makes a wireless designer's heart beat faster. Perhaps it's having the ability to control numerous devices remotely from one location that's so appealing about wireless technology. Or maybe it's simply an aversion to wire clutter and a penchant for mobility that has designers so spirited about it. Whatever that "something" may be, most designers can't resist a new opportunity to work with top-notch wireless components like Freescale's MC13191/92/93 RF transceivers.

The enthusiasm shown for the 2004 Freescale Wireless Design Challenge is a case in point. The moment we announced the start of the contest, dozens of prospective entrants began brainstorming innovative MC13191/92/93-based wireless designs. Only hours later, project number requests for many of these designs were streaming in at a steady pace. In less than a week's time, the design community was abuzz with excitement over the contest, and scores of designers were already hard at work on their projects.

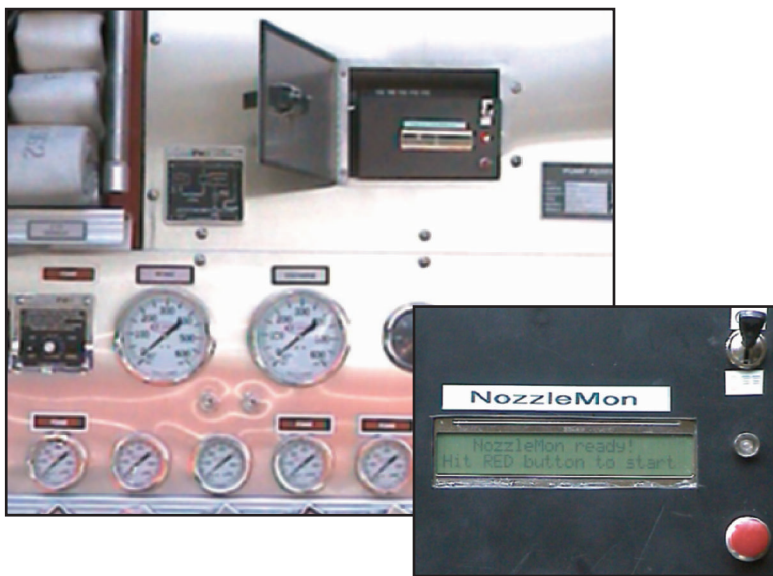
Well, now is the moment everyone's been waiting for. It's time to recognize the standouts. Congratulations to all of the winners, especially Mitchell Levinn, who has been awarded the Grand Honor for his NozzleMon system.

### Grand Honor

#### NozzleMon

The well-designed NozzleMon system monitors the pressure and relative motion of the nozzle at the end of a water hose. The NozzleMon then relays the information back to the pump operator. A 13192-EVB serves as the controller in the pump panel unit, which includes a 2 × 24 LCD to show pressure readings and messages, a bright red LED for indicating problems, a push button for indicating a set pressure, and a toggle switch for turning on the power. An MC13192 SARD board serves as the nozzle's processor. Pressure sensing is achieved with an MPXH6400 sensor. Position sensing is accomplished with the x- and y-axis (MMA6261Q) and z-axis (MMA1260D) accelerometers on the SARD board.

**Mitchell Levinn**  
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**For complete contest entries, visit**  
**[www.freescale.com/wirelesschallenge](http://www.freescale.com/wirelesschallenge).**

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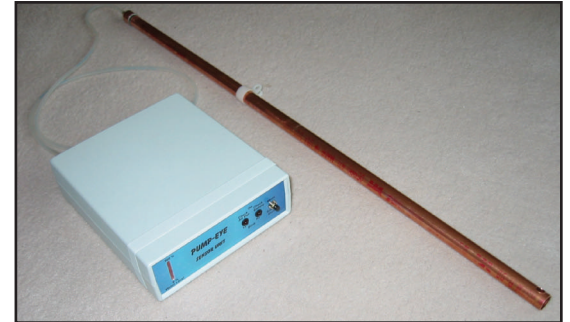
### First Honor

#### Pump-Eye

The flexible Pump-Eye is a three-unit water level monitoring system built around MC9S08GT60 and MC9S12NE64 microcontrollers. The sensor unit monitors the water level in a sump pump pit, the sump pump's AC power, and the sensor unit's backup battery. The base unit receives status information from the sensor unit via RF. The sensor and base units use MC9S08GT60 microcontrollers; they communicate with each other via 2.4-GHz transceivers based on an MC13192 SARD board. The Ethernet link creates and sends timestamp and log messages to a host when the pump runs. The system sends a warning e-mail when the water level is high or there's a power failure. An alarm sounds when the water level exceeds the normal maximum height by 10%.

**David Kanceruk**

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### Second Honor

#### Magic Wah: Wireless Musical Expression Pedal

The Magic Wah wireless pedal is a musician's dream accessory. The impressive system—which consists of two devices that communicate with each other point-to-point using the 802.15.4 PHY layer—includes a pair of MC13192 SARD boards containing an MC9S08GT60 microcontroller, an MC13192 RF transceiver, and two accelerometers. To operate the pedal, the musician must wear a transmitter on his foot. The receiver plugs into the musical instrument's signal path. The transmitter constantly monitors the angle of the musician's foot and transmits the data to the receiver.

**Bill Bishop**

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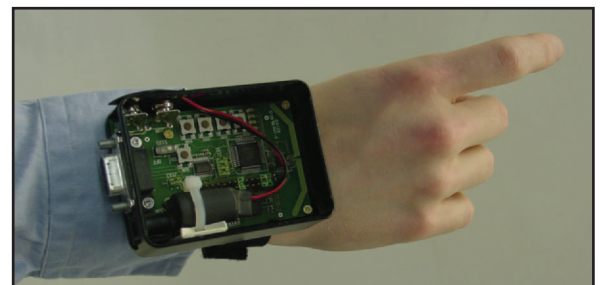
### Third Honor

#### WIPES: Wireless Identification of Persons using Ethereal Signatures

With the amazing WIPES biometric authentication system on your wrist, you can write your signature in the air. This ingenious wireless device—which utilizes the accelerometers and MC9S08GT60 MCU on an MC13192 SARD board—can be used in the public and private sectors for the purposes of identification and secure access control.

**Richard Haskell, Eric McGrath, and Kevin Van Sickle**

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### Electronic Scarecrow

The Electronic Scarecrow is a high-tech solution to a problem endemic to rural communities: unwanted animals foraging for food in backyard gardens. The effective system keeps animals away by using four remote stations designed around MC13192 SARD boards. Each board is connected to several sensors that transmit to the base station's evaluation board. When an animal is detected, the base can activate countermeasures like loud sounds and running the water sprinklers. The remote and base stations are based on an MC13192 2.4-GHz transceiver controlled by an MC9S08GT16 MCU.

**Richard Wotiz**  
dick601@mystics.org



### Musical Gloves

The wearable Musical Gloves enable you to play various forms of music on virtually any surface. This exciting wireless system is built around an MC13192 SARD board's MC9S08GT60 MCU, MC13192 transceiver, and MMA6261Q (x- and y-axis) and MMA1260D (z-axis) accelerometers. The gloves are instrumented with fingertip switches and the three axis accelerometers. The system tracks finger presses, which start and stop notes, and hand motion, which determines the loudness and octave of each note. The Musical Gloves are connected via a wireless RF connection to a host PC, which processes the finger presses and accelerometer readings in order to control the musical output.

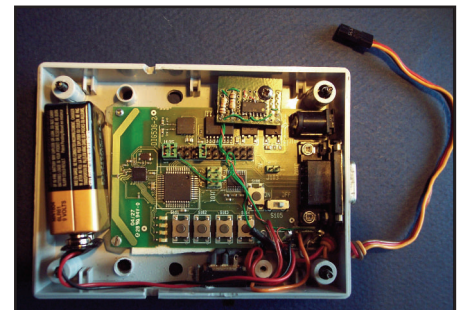
**Steve Kranish**  
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### RC Helicopter Downlink Telemetry Module

With this clever on-board telemetry module, you can collect vital flight information about RC aircraft. The module sends information via a wireless ZigBee link to a ground station consisting of a laptop computer and a ZigBee receiver. The system is implemented using an MC1392 SARD board with a few modifications. A voltage follower built with an LM2904 op-amp and a simple resistor divider are wired to channel 2 of the ADC on the SARD board's on-board MC9S08GT60 microcontroller. The telemetry system is expandable enough to support the monitoring of the engine's RPM as well as altitude and airspeed.

**Leonid Shvarzberg**  
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## Wireless Design Challenge

### Honorable Mention

#### **HAXOR: Home Automation and Observation Remote**

The MC9S08GT60 microcontroller-based HAXOR is an innovative general-purpose remote control infrastructure designed for next-generation homes, offices, public venues, and other smart environments. The remote control with a user-friendly LCD interface can control any device or actuator connected to the 802.15.4 mesh network. Using an MC13192 SARD board, this sophisticated system is designed around wirelessly networked remote control, sensor, and actuator nodes.

**Jacob Adriaens and Seapahn Megerian**  
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#### **Hi-Fi Preamplifier with ZigBee Remote Control**

Designed around an MC13192 SARD board and an 8-bit microcontroller, this project is a well-designed, simple audiophile-grade preamplifier. The low-cost remote control uses an accelerometer on the SARD board to sense tilting to the left or right to control the volume, treble, and bass levels.

**Radu Constantinescu**  
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#### **GPS Surveyor**

The GPS Surveyor is an effective tool for acquiring precise position data for surveying and vehicle tracking applications among others. Two GPS receivers gather the data, which is then downloaded to a laptop for processing. The system comprises two modules, each including a GPS receiver and antenna, a ZigBee transceiver and antenna, and both accelerometers and the MC9S08GT60 microcontroller from an MC13192 SARD board.

**Thomas Dvorak**  
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#### **ZigBee Wireless Swimming Trainer**

A coach can use this ambitious project to train swimmers to qualify for the Olympics. The affordable system monitors, transmits, and records multiple swimmers' movements and speeds using a combination of Freescale devices, including an MC33794 e-field device and resources from an MC13192 SARD board—an MC9S08GT60 microcontroller, an MMA1260D z-axis accelerometer, an MMA66261Q x- and y-axis accelerometer, and an MC13192 ZigBee wireless controller.

**Earl Foster, Charles Fricker, and Tom Morgan**  
foster@cfl.rr.com

#### **Virtual Interactive Boxing**

The creative Virtual Interactive Boxing system makes shadow boxing more interesting by providing a virtual opponent with whom to spar. Designed around an MC9S08GT60 microcontroller and an MC13192 RF transmitter, the system monitors the user's performance. Enhancements include digitized audio and speech that provide motivational cues and feedback about the user's performance to help him improve his technique.

**Themi Kotsiras**  
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#### **Robot Localization and Control**

The well-designed ZigBee-based Robot Localization and Control project uses wireless nodes to simultaneously localize and control the humanoid robot Robosapien by Wow Wee. The ZigBee nodes' outputs mimic the control signals the robot would normally receive. A user-friendly GUI display makes controlling the robot easy.

**Ethan Leland**  
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#### **RC Battleship**

This project uses an MC13192 SARD board and an MC33794 e-field sensor to effectively upgrade the traditional RC system for a remote-controlled ship. The system has advanced capabilities to control eight servos located across three turrets and steering, three pneumatic firing valves, the bilge pumps, and the PWM main drive.

**Stephen Morgret**  
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#### **Emaze**

Designed around an MC33794 e-field device and an MC13192 SARD board, Emaze monitors and records the locomotion functions of small rodents. This data is used to research the effects of and pharmaceutical treatments for human neurodegenerative diseases, including Parkinson's, Huntington's, and Alzheimer's diseases. Emaze's user-friendly format and low cost make it ideal for laboratory use.

**Huifang Ni, Xinmin Xie, Jingxi Zhang, and Yang Zhang**  
jingxi@gmail.com

#### **Nintendo Virtual Joystick**

An innovation for Nintendo 64 and GameCube users, the Nintendo Virtual Joystick uses ZigBee technology and MC13192 SARD boards to eliminate joystick wires that limit a player's range of movement. The MC9S08GT60 microcontroller-based system enables players to move about freely as they use the wireless remote control.

**Huifang Ni, Jingxi Zhang, and Yang Zhang**  
jingxi@gmail.com

#### **ZigBee Motorcycle**

For this successful MC9S08GT60 microcontroller-based project, a 13192-EVB serves as the basis to test a piezoelectric vibrating gyroscope-based balancing system. Replacing the original radio controller in a toy motorcycle, the board now drives the remote-controlled unit. The steering control mechanism was replaced with a more precise RC servo. The piezoelectric vibrating gyroscope provides fast turn rate indication for use in stabilizing the cycle while the motorcycle is running.

**Jay Schroff**  
jschroff@hotmail.com

#### **The Everything is OK Alarm**

This sophisticated home security system ensures peace of mind. Based on the MC13192 SARD board, the system uses wireless sensors to monitor the garage door, indoor and outdoor temperatures (for maintaining heat/air conditioning systems and water pipes), and the water level in the sump pump hole. The user can call home and enter a security code to receive a status report about the conditions in his house.

**Carl Smith**  
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#### **PageAlert: A Remote Sensing System**

The well-designed PageAlert is a flexible remote sensing platform connected to a data recording and alarm system. It is based on an MC13192 SARD board. An MPXM2010 pressure sensor effectively senses the water level in a sump pump hole. The limited transmission range of ZigBee technology makes this wireless system ideal for home use.

**William Wittig**  
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