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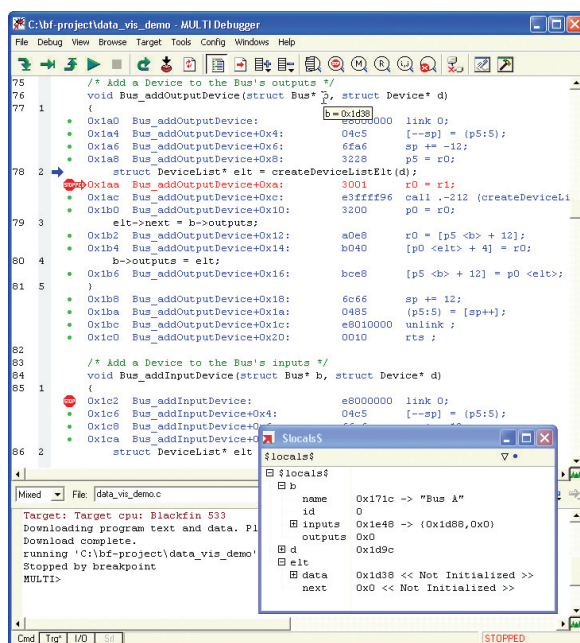
Peiker acoustic's strategy in developing its hands-free system has been to rely on best-of-breed off-the-shelf components wherever possible, such as Analog Devices' Blackfin microprocessors and Green Hills Software's INTEGRITY RTOS.

Peiker developing OEM Bluetooth system

Using a cell phone in an automobile is becoming a lot safer. Automobile manufacturers are beginning to give drivers and passengers the ability to connect their existing cell phones to an in-car hands-free system that does not require interaction with a display, providing motorists with a convenient and safe way to use their cell phones while driving. These new hands-free systems are based

on the Bluetooth wireless protocol, which is already supported by many cell phone manufacturers including **Nokia**, **Siemens**, and **Sony Ericsson**.

Bluetooth kits—which provide the ability for closer integration with vehicle sound, steering wheel controls, caller-ID displays, and other systems—have been available for a few years for aftermarket installation and have been offered more recently as line-fitted options on a small number of vehicles. **Peiker acoustic** entered the Bluetooth automotive market several years ago with a dealer-installed kit, then made the decision to develop a line-fit version on its own. The company's strategy in developing the hands-free system has been to rely on best-of-breed off-the-shelf components wherever possible, such as **Analog Devices'** Blackfin family of microprocessors and **Green Hills Software's** INTEGRITY real-time operating system (RTOS). Peiker integrates the technologies with its application software and then takes advantage of the RTOS's ability to dynamically accept new features without recompiling to provide leading-edge functionality and easily adapted features for its customers.



Peiker debugged the code for the hands-free system using Green Hills' MULTI development environment.

Hands-free systems enter market

DaimlerChrysler was the first North American car manufacturer to offer a

Bluetooth hands-free system, using technology developed by Peiker, which not only supplies microphones, loudspeakers, handsets, car kits, telematic solutions, and other products to DaimlerChrysler, but also to **Ford, Mercedes-Benz, BMW, Volkswagen**, and other OEMs.

DaimlerChrysler's UConnect system is available as an aftermarket kit that can be installed by dealers in almost all DaimlerChrysler vehicles back to 1994. The motorist can talk through the vehicle's onboard microphone and listen through its speaker via a personal cell phone that can be located anywhere in the passenger compartment. Users interact with the phone almost solely through the use of speech, without having to read the display or key-in information. The voice-recognition system responds, confirms the number, and dials. The user can also transfer a call from the vehicle's system to the mobile phone.

Peiker's hands-free system consists of a control pad, speaker, microphone, wiring harness, and a control module containing the voice-recognition software and the Bluetooth chipset. By offering UConnect through **Mopar**, Chrysler customers will be able to choose a hands-free communication system that is affordable, simple to use, and easily installed into their new **Chrysler, Jeep, or Dodge** vehicle by trained service personnel at their dealerships.

The next generation

Peiker is moving ahead in the development of a more advanced system designed for OEM installation on the assembly line. The new system, for which the company already has a contract with a leading automobile manufacturer, will use the vehicle bus to communicate with the radio, providing a much higher level of integration than was possible in the past. For example, the phone number of incoming calls will now flash on the radio display. This approach also saves space and money by making it possible to use the existing audio system of the car, rather than adding an additional speaker and microphone as with current aftermarket systems.

The new Peiker hands-free system supports several automotive buses including the Controller Area Network (CAN) and J1850. It implements a much more powerful architecture based on Analog Devices' Blackfin microprocessors, which combine a 32-bit Reduced Instruction Set Computer-like instruction set with dual 16-bit multiply accumulate (MAC) signal-processing functionality and the ease-of-use attributes found in general-purpose microcontrollers. The combination of processing attributes enables the microprocessors to perform equally well in both signal- and control-processing applications, in many cases removing the requirement for separate heterogeneous processors.

"The Blackfin processor delivers anywhere from 450 to 800 MIPS, providing substantial power for a multitude of different features to be easily incorporated," said Samir Tailor, Director of Business Development for Peiker. "The use of a microprocessor instead of a digital signal processor provides the ability to use a true RTOS, which in turn abstracts the application from the hardware, making it possible to upgrade the applications without changing the communications between the microprocessor and the other hardware."

"The selection of the RTOS was one of the key decisions upon which the success of the project depended," Tailor added. "Since the technology in this area is evolving fast, we needed a way to dynamically bring new features onto the platform without having to recompile the operating system. We found only two RTOSs on the market that offered this capability. INTEGRITY is the only RTOS that could be dynamically compiled and come up fast enough for use on automotive buses. It also has the advantage of being royalty-free and supported by the very powerful MULTI integrated development environment."

Overcoming development challenges

As the system designer/integrator and application software developer, Peiker works closely with several key partners.

"The Bluetooth code, voice-recognition software, noise-reduction software, and board support package that provides low-level communications between the process and peripherals are each provided as components by suppliers," Tailor said. "We are integrating these components and developing the application layer that provides the key hands-free functionality. Our selection of INTEGRITY has been integral to the success of this project to date. The fact that INTEGRITY is 30 to 40% smaller than the other RTOSs that we considered gives us more room for components and our own code. The Green Hills development environment makes it easy to set break points, run traces, and provides statistical analysis on which components take the most time to run. We run the statistical analysis to see what part of the code takes the most time to run. That provides the information we need to easily identify and solve performance problems. We use the tracer to zero in on the problem, make changes to the code, then run the statistical analysis again to see whether or not we fixed the problem."

The entire development cycle has its challenges. After integrating the various hardware and software components including the operating system, the product is released to the OEM for testing. Based on its feedback, Peiker refines and finalizes the application layer. Then the product moves into the design-validation stage, where it is installed on prototype vehicles and run through additional testing. The use of a true operating system makes it possible to upgrade and improve the system much faster. Peiker is able to add features quickly by uploading them to the hardware without worrying about the impact on low-level functionality that is managed by the operating system.

Future Peiker products will include enhanced in-vehicle communications solutions that meet the specific needs of customers in the automotive market.

*This article was written by **Bruce Clutton**, CEO, Peiker acustic.*

