High-Mobility Tactical Micro-Robot Enters the Field with InHand's Fingertip Technology

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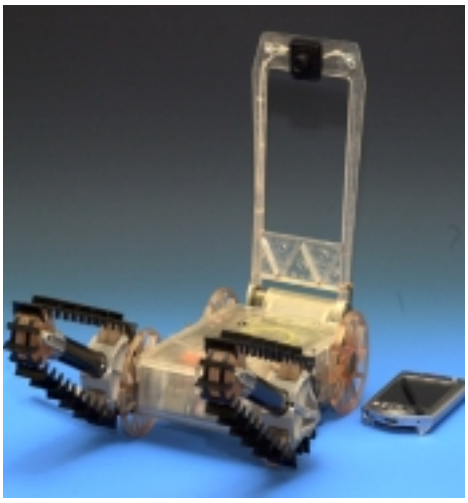
Synopsis:
What's the revolution in Draper's High-Mobility Tactical Micro-Robot? Size! This robot has been designed from the ground up to be small and lightweight, yet very rugged and highly capable of performing sophisticated actions. As a research project funded by Dr. Elana Ethridge of the Defense Advanced Research Projects Agency (DARPA) Microsystems Technology Office (MTO), the goal is to eventually have the ability to quickly and massively deploy these robots anywhere in the world. Imagine a battalion of robots parachuting into enemy territory to perform their fighting tasks.

The future is here, and with the Fingertip platform and the Intel® SA-1110 StrongARM®, the robot is a reality.

DARPA-Sponsored Project Incorporates InHand's Low-Power Solutions

It's less than 20" long. It weighs 4 lbs. It has high mobility and you remotely control it via an RF link. No, it's not the latest radio-controlled toy race car. This gadget is an autonomous robot, and its ambitious goal is no less than a complete paradigm shift in the implementation and fielding of robots.

DARPA and Draper knew they would need a sophisticated computing platform with extremely low power consumption and extremely small size in order to realize their vision of an army of mini-robots. They found it in InHand Electronics' Fingertip platform for the ARM core-based Intel® StrongARM® SA-1110 processor with BatterySmart dynamic power management software. As Rob Larsen, a Program Manager in Draper's Special Operations Office puts it, "to go beyond traditionally larger robots, we knew we'd need a computing engine that could deliver excellent performance in a very small form factor and with sub-watt power consumption. We considered a number of approaches, and ultimately we turned to InHand. The Fingertip platform combined with BatterySmart power management software really allowed us to meet our size and weight goals by reducing our power and size budget without sacrificing performance."



The HP iPAQ handheld and the Micro-Robot communicate over a wireless link to a PDA. The user can view camera images and control the robot remotely. Future versions will have autonomous guidance, navigation, and control.

How It Works

Draper's robot contains a pair of cameras that feed data to an image compression board. Fingertip technology, at the top of the control stack on the robot, receives the image data over a high-speed serial link, and subsequently transmits the data off of the robot via an 802.11 wireless link. The image data can then be received, decompressed, and viewed on a handheld device, such as an HP iPAQ. Additionally, software on the handheld device allows the user to remotely control the robot's actions. These commands go back to the robot's Fingertip platform via the wireless link, and Fingertip then interfaces with a motor control board to operate a series of motors that maneuver the robot. All of the software on Fingertip is implemented in Microsoft's Windows CE.

Development of the serial connection between the image board and the

Fingertip platform was a crucial piece of the development work. The link had to be very high-speed to minimize control latencies. InHand and Draper worked together to optimize the software driver for Fingertip's synchronous serial interface. As a result, the image board was able to communicate with Fingertip at the maximum rate of 1.8Mbps, thereby reducing the round-trip delay from image acquisition and wireless transfer to control activation on the handheld and motor operation on the robot.

From start to finish, the entire project will be completed in less than 18 months. The robot is designed to operate for a period of time between 30 minutes and 2 hours, depending on operations, with a 250g NiMH battery pack. Initial prototypes will be used as demonstrators and for future technology exploration.

The Future of Robots

Draper's work presents many interesting questions, both technologically and philosophically. The folks at Draper and DARPA have a variety of ideas for future implementations, including long-range cellular-based wireless control. Also, with the computing power of the Fingertip platform, Draper will be including sophisticated guidance, navigation, and control algorithms, coupled with a variety of onboard sensors to allow the robot to make its own decisions. "We've just scratched the surface on what can be accomplished with robots," notes Kevin Toomey, Draper's Technical Director for the DARPA project. "As with everything else in computing, once you reduce the size to a certain point and go to wireless communications, applications abound. DARPA's support for this project has been tremendous, and InHand's products and support staff have really helped us get our project going quickly."

For more information on InHand, visit: www.inhandelectronics.com

Fingertip Reference Design

At just 7.5 square inches and incorporating optional wireless and location capabilities, Fingertip is the smallest complete PDA platform available today. Based on InHand's award-winning technology, Fingertip features an Intel® StrongARM® or XScale® CPU, providing over 200MHz of processing power, providing dynamic clock- and voltage-scaling features, and consuming only 500mW. With a minimum input voltage of just 3.6VDC, Fingertip also reduces battery size requirements over other platforms. An array of standard peripheral interfaces are included and a variety of LCD displays are supported.