

# QUESTIONS & ANSWERS



## Advanced Robot Technologies

### An Interview with Hanno Sander

*Electronics have always captivated Hanno Sander, who began programming at an early age. His interests in science and technology led him to start his own company, which enables him to collaborate with other engineers to design robots and create development environments. In January, I interviewed Hanno about his engineering interests, book writing, and the future of artificial intelligence.—Nan Price, Associate Editor*

**NAN: You moved to New Zealand in 2005. Why did you end up there?**

**HANNO:** My wife and I fell in love with the New Zealand lifestyle during our honeymoon, so we moved to Christchurch after the birth of our first child. Even with the recent earthquakes, we love living in a community that places top value on family life. We take full advantage of the beautiful beaches and scenery that New Zealand offers. It's also exciting as an engineer to be surrounded by innovative Kiwis who love to tinker. It seems like everyone here has a steam engine in their garage.

**NAN: You have always had a passion for electronics. In fact, you programmed a lunar lander game for the z80 when you were just 6 years old! When did you realize you were so interested in engineering? Were you inspired by a family member or teacher when you were young?**

**HANNO:** My mom taught high school physics and math, while my dad pioneered optical recording at Philips Electronics. From an early age, I've loved learning how things work and building new things. Growing up, I spent countless hours with Legos, Meccano erector sets, Märklin train sets, computers, and remote-controlled toys. My dad continues to be a patient mentor with a passion to distill complex concepts onto a single piece of paper.

**NAN: Tell us about that game you designed at age six.**

**HANNO:** I think I've always loved to teach people about science and technology. I wrote my Lunar Lander game after learning about the Apollo space missions to share my knowledge with my younger sisters. The game included a simulated rocket launch, a flight through a meteor field, a controlled descent onto the moon, and then a return to

earth with a parachute-assisted splashdown into the ocean. This was programmed on my dad's self-built z80 complete with 1022-byte sectors read from tape, a homemade keyboard, and four potentiometers for analog control.

**NAN: Where did you go to school and what did you study?**

**HANNO:** I studied computer science at Stanford University in California. I loved learning from my professors and fellow students but had even more fun developing a hybrid car and a microsatellite. I graduated in three years to start my first company, Daptyx, an interactive online newspaper. After making some money from my start-up, I brought several advanced technology projects to market during my Silicon Valley career at Oracle, Yahoo!, and Verity.

**NAN: Tell us about your company, HannoWare. Describe some of your projects.**

**HANNO:** HannoWare is my attempt to share my hobbies with others while keeping my kids fed and wife happy. It started with me simply selling software online but is now a business developing and selling software, hardware, and courseware directly and through distributors. I get a kick out of collaborating with top engineers on our projects and





DESIGNSPARK

Deadline for Entries: March 27, 2012

Turn a **hot**  
**idea** into a  
**cool**  
**solution.**

## DesignSpark chipKIT™ Challenge

Get ready to win your share of \$10,000 in cash prizes!

It's time to see if your hard work and superior engineering skills have paid off. The deadline for the **DesignSpark chipKIT™ Challenge** is just around the corner. It's time to finalize your design and prep your entries for the judges!

Will your design change the world? Reduce power consumption? Improve energy efficiency? There's only one way to find out.

Manage your project entry by clicking on the 'My Project' tab at [www.designspark.com/chipkitchallenge-projects/latest](http://www.designspark.com/chipkitchallenge-projects/latest). Be sure to upload, and clearly label, all materials necessary for judging your entry including an abstract, complete documentation, and source code.

For more information and tips on how to enter, visit [www.designspark.com/chipkitchallenge/faq](http://www.designspark.com/chipkitchallenge/faq).

**Don't delay! The DesignSpark chipKIT™ Challenge ends on March 27, 2012 at 18.00 GMT (13.00 EST).**



Visit [www.chipkitchallenge.com](http://www.chipkitchallenge.com)

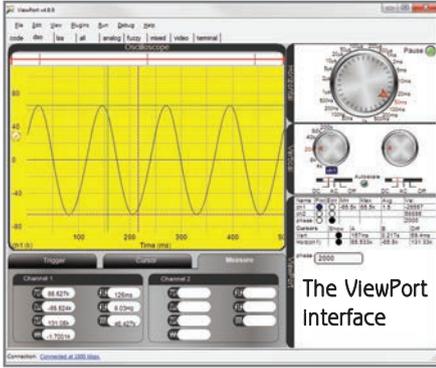
for complete rules and details.

IN ASSOCIATION WITH:



chipKIT™ is a registered trademark of Microchip Technology Inc.

Max32™ is a registered trademark of Digikey, Inc.



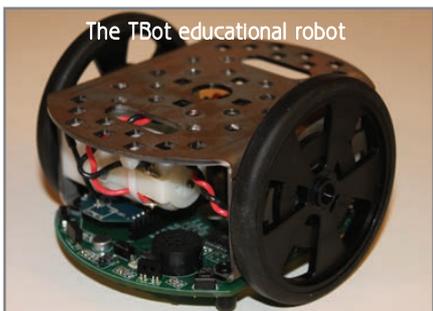
The ViewPort Interface

love hearing from customers about their success.

Our first product was the ViewPort development environment for the Parallax Propeller, which features both traditional tools like line-by-line stepping and breakpoints as well as real-time graphs of variables and pin I/O states to help developers debug their firmware. ViewPort has been used for applications ranging from creating a hobby Turing machine to calibrating a resolver for a 6-MW motor.

12Blocks is a visual programming language for hobby microcontrollers. The drag-n-drop style of programming with customizable blocks makes it ideal for novice programmers. Like ViewPort, 12Blocks uses rich graphics to help programmers understand what's going on inside the processor. The ability to view and edit the underlying sourcecode simplifies transition to text languages like BASIC and C when appropriate.

TBot is the result of an Internet-only collaboration with Chad George, a very talented roboticist. Our goal for the robot was to excel at typical robot challenges in its stock configuration while also allowing users to customize the platform to their needs. A full set of sensors and actuators accomplish the former while the metal frame, expansion ports, and



The TBot educational robot

software libraries satisfy the latter.

**NAN:** Tell us about your PropScope design, which is one of the projects featured on your company's website ([www.hannoware.com](http://www.hannoware.com)).

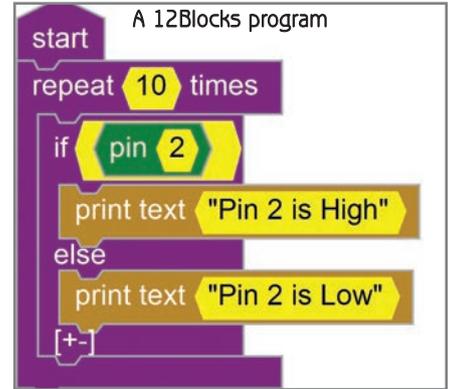
**HANNO:** The PropScope is a multi-function USB oscilloscope built around the Parallax Propeller microprocessor. The Propeller's eight cores allow it to sample and analyze both digital and analog signals at high speed while generating customizable waveforms. Students and engineers use the PropScope as an affordable tool to understand and share electronic signals.

**NAN:** You have given several "Tech Talks" at Google. Tell us a little about the talks and how you came to be involved.

**HANNO:** I first heard about Google when my senior project advisor at Stanford told me to talk to a couple guys who were indexing the Internet—sadly, I didn't follow his advice. I now make an annual pilgrimage to the Googleplex to lunch with friends, marvel at a SpaceShipOne replica, and talk about the projects I'm involved with. The Tech Talks are filmed on an elaborate stage with a slew of robotic cameras and lights resulting in a quality production.

**NAN:** In addition to designing and presenting, you've also done a fair amount of writing, including an article for *Circuit Cellar* and a soon-to-be published book about advanced robotics. In your 2009 article, "Vision-Guided Robotics: A Next-Generation Balancing Robot" (*Circuit Cellar*, 224), you introduced the DanceBot, a balancing robot you built with a Parallax Propeller, a handy design kit, and a camera. Tell us how the DanceBot has evolved since then.

**HANNO:** I developed the DanceBot right when my son was learning to walk, so I challenged myself to get my robot to take a step before my son. The DanceBot did win, but my son has evolved much further since. I've been reluctant to bring a vision-guided



balancing robot to market in this economy, but it's still on my to-do list. I did contribute several chapters about the DanceBot to another book, *Programming and Customizing the Multicore Propeller Microcontroller: The Official Guide*, and the hardware and software are available as part of the open-source Propeller Smorgasboard project.

**NAN:** Your upcoming *Circuit Cellar* book covers all things robotics, from microcontrollers and peripherals to visual debugging and test instruments. The book is designed for DIYers, computer science students, and professional engineers alike. What was your impetus for writing the book? What can readers expect to learn from it?

**HANNO:** There are plenty of books that introduce people to robotics. I wrote my book to appeal to those looking for more meat on more advanced subjects like computer vision, control



The DanceBot

algorithms, and wireless control. My goal with each topic was to provide some technical background, code, and schematics to explain the concepts and then discuss applications and best practices.

**NAN: Why such a strong interest in robotics?**

**HANNO: I think robots are a wonderful tool to help people relate to the abstract concepts inherent in science, technology, engineering, and math (STEM) subjects. Since the industrial revolution, people have fantasized about interacting with mechanical creatures and we're lucky enough to live in the age where they're becoming real.**

**NAN: Aside from advanced robotics, what other electronics engineering topics interest you and why?**

**HANNO: I'm a big advocate of science and technology and love learning about new developments in both. I'm currently excited about the rapidly decreasing cost of photovoltaic power, applying the storage capacity of lithium batteries to revolutionize existing products, and the flexibility of additive manufacturing (e.g., 3-D printers).**

**NAN: We often ask interviewees about their predictions for**



The Parallax PropScope

**upcoming "hot topics." Some recent answers have included: DSP and compressive sensing, smaller and faster CPUs, and hardware design using programmable logic. What are your thoughts?**

**HANNO: Today's computing devices feature incredible horsepower, memory, and connectivity to basically all of human knowledge in addition to high-definition cameras and other sensors. We're starting to see artificial intelligence in commercial offerings with IBM's Watson and Apple's Siri. I think that, for better or worse, the trend over the next decade is to bring human-level intelligence to devices all around us.**

**NAN: Final question: If you had a full year and a good budget to work on any design project you wanted, what would you build?**

**HANNO: I like to think that HannoWare gives me the flexibility to pursue my passion. I'm currently very excited to work with teachers from kindergarten through university on a set of videos, example programs, and supporting resources that conform to New Zealand's curriculum standards. We've set up the OneRobot organization to help typical schools to enhance their offering with resources that have been proven to get results. 📺**

# RF Specialists

### RF Modules

From Part 15 to Part 90 Compliant  
Narrow Band FM, UHF Multi-Channel

### GSM/GPRS

M2M Solutions  
GSM/GPRS modules and modem series

### Industrial Bluetooth

OEM, Modules, Wireless Device Servers, RS-232  
Long range options, low cost

### Data Loggers

Stand Alone and  
Wireless Mesh Networking Logger

### GPS

OEM Modules and USB ZigBee Sticks,  
Mesh Networks

### ZigBee Pro

OEM Modules and USB ZigBee Sticks,  
Mesh Networks

### Wi-Fi

**RS232 / 422 / 485 to Wi-Fi Adapter**  
Connect Data Acquisition Equipment through Serial Port to Wi-Fi network

**LEMOS INTERNATIONAL**  
www.lemosint.com  
866.345.3667  
sales@lemosint.com

- Boards • Kits • Modules • Components • Tools • Instruments
- FOR
- Companies • Professionals • Students • DIYers • Amateurs

**USB STC 8051 MCU Programmer**  
Free For 8051 Developers  
**\$0** Add to cart

**STM32+OV7725 Camera Dev Kit**  
Make Your Own Camera In Minutes  
**\$80** Add to cart

**NRF2401 2.4G Transceiver Module**  
Small, Versatile, Simple, Ultra Low Power  
**\$7.5** Add to cart

**LM3886 68Wx2 HiFi Audio Amplifier**  
HiFi Sound At Affordable Price  
**\$49.9** Add to cart

Simplify your electronics projects by visiting  
<http://www.siliconray.com>