

Building Sophisticated, yet Affordable Robots with ViewPort and the Parallax Propeller

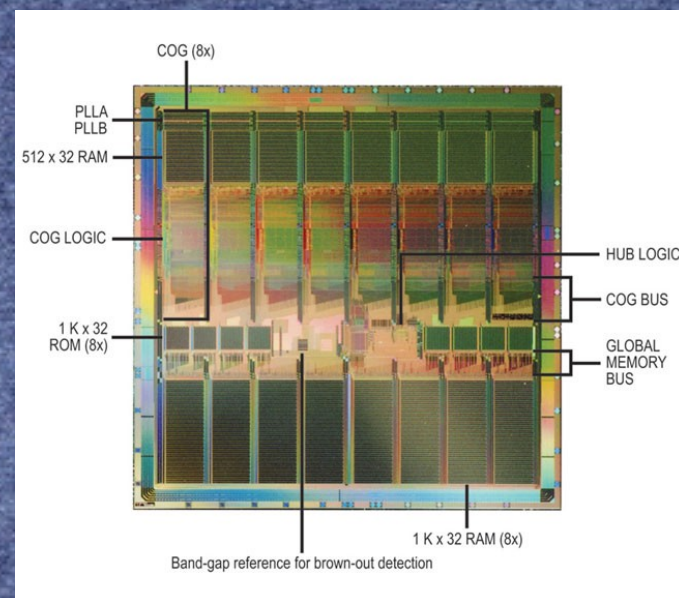
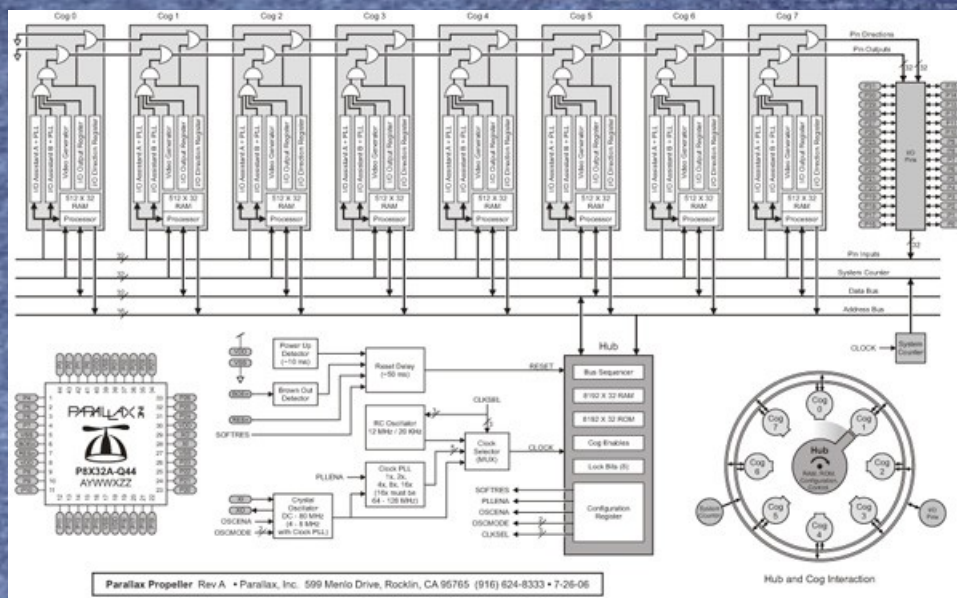
Hanno Sander
Google Tech Talk
May 12th, 2009
<http://mydancebot.com>

Demos:

- DanceBot balancing and guided by vision
- Tune DanceBot with ViewPort
 - measure tilt, position, IO, NTSC
 - Tune fuzzy logic
- Debug Propeller Spin Code
- Steer Simulated DanceBot with OpenCV
- PropScope

Parallax Propeller

- Eight 32 bit processors @80MHz for \$8
- Divide sophisticated projects into 1 cog/task.
- Spin high level object oriented language
- Asm fast enough to input/output video signals.



Demo #1: DanceBot



Sensors

Camera

Quadrature Encoder

Gyroscope
Accelerometer

Pre-Process

Location of Person

Position, Velocity

Tilt, Rate of Turn

Logic

Find person and
set target position

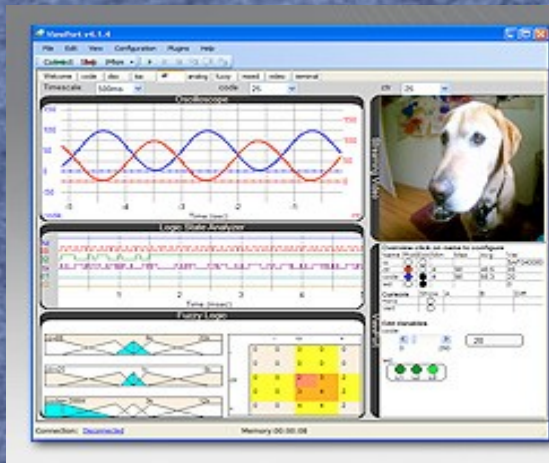
Fuzzy PID Loop to
balance and
achieve target
position

Actuators

Drive 2 Motors

Dancing with 8 Cogs

ViewPort Debugger



Monitor/Change Variables
Analyze Data
OpenCV Vision Engine
PhysX World Simulation
Integrated Debugger

Propeller w 8 Cores DanceBot

Software Frame Grabber
NTSC->ADC->4 Pins
Memory

Image Processing
Frame->Variables

Position
Encode pulse
length/phase

Tilt
SPI Accelerometer
Hobby Gyro

Kalman
50Hz update to
eliminate drift

Fuzzy Control
Balance and
Keep position

PWM
Proportional fwd/rev

Conduit
Share Data

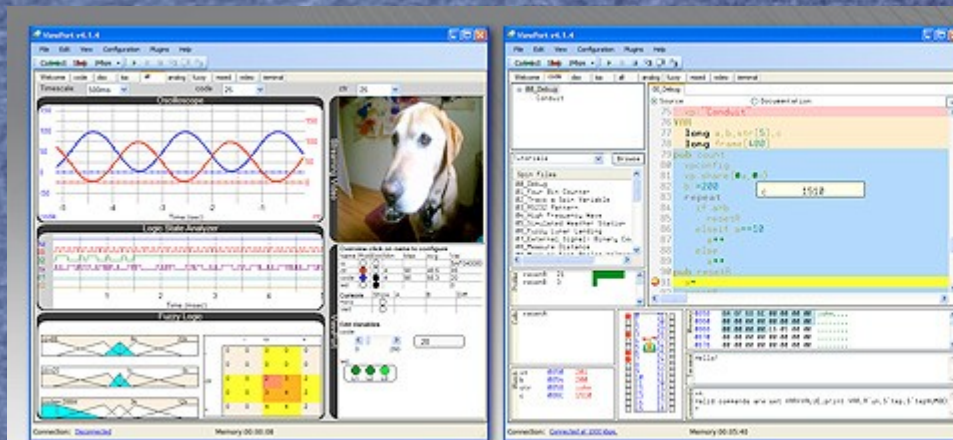


Gyro
Accelerometer
Encoder
Camera

Motors

Demo #2: ViewPort

- Debugging Tool
- Monitor/Change variables in live program
- Simulated Instruments: DSO, LSA, Spectrum...
- Computer Vision: OpenCV
- More coming soon: Simulated physics



ViewPort Software

The premier debugging environment for the Propeller. The tool combines an integrated debugger with powerful graphics that show you what's going on within the chip!



ViewPort

Propeller
Shared Memory
and Input/Output

Your Program
on 7 Cogs

ViewPort shares
data using 1 Cog

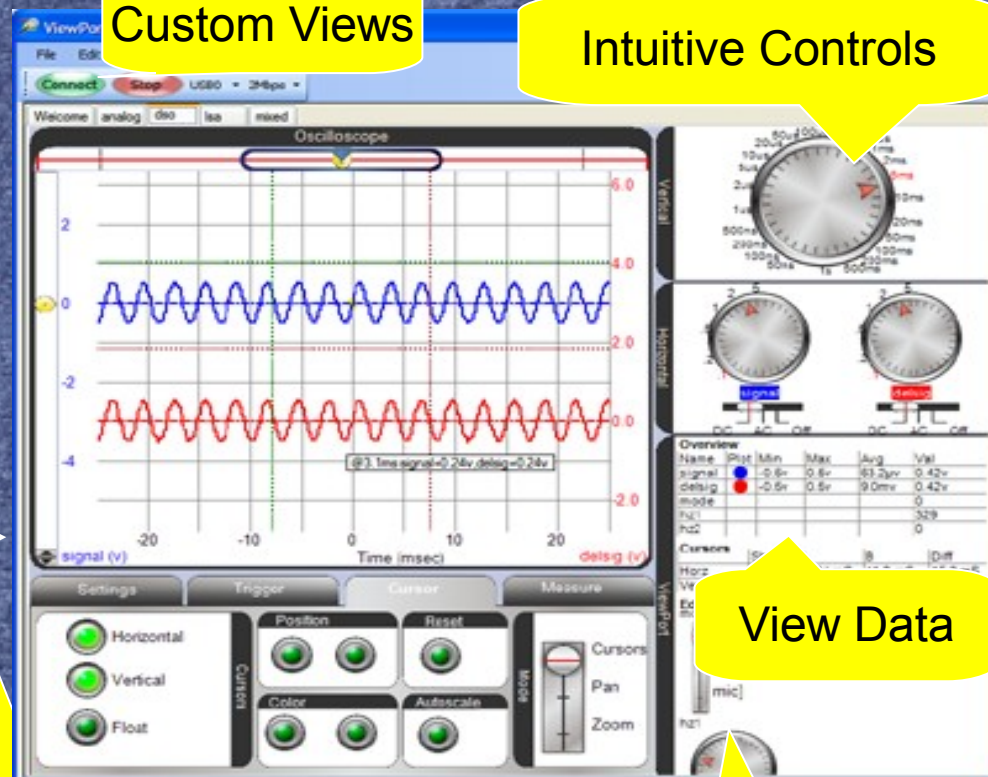
Stream Data over USB at 2Mb/S

Custom Views

Intuitive Controls

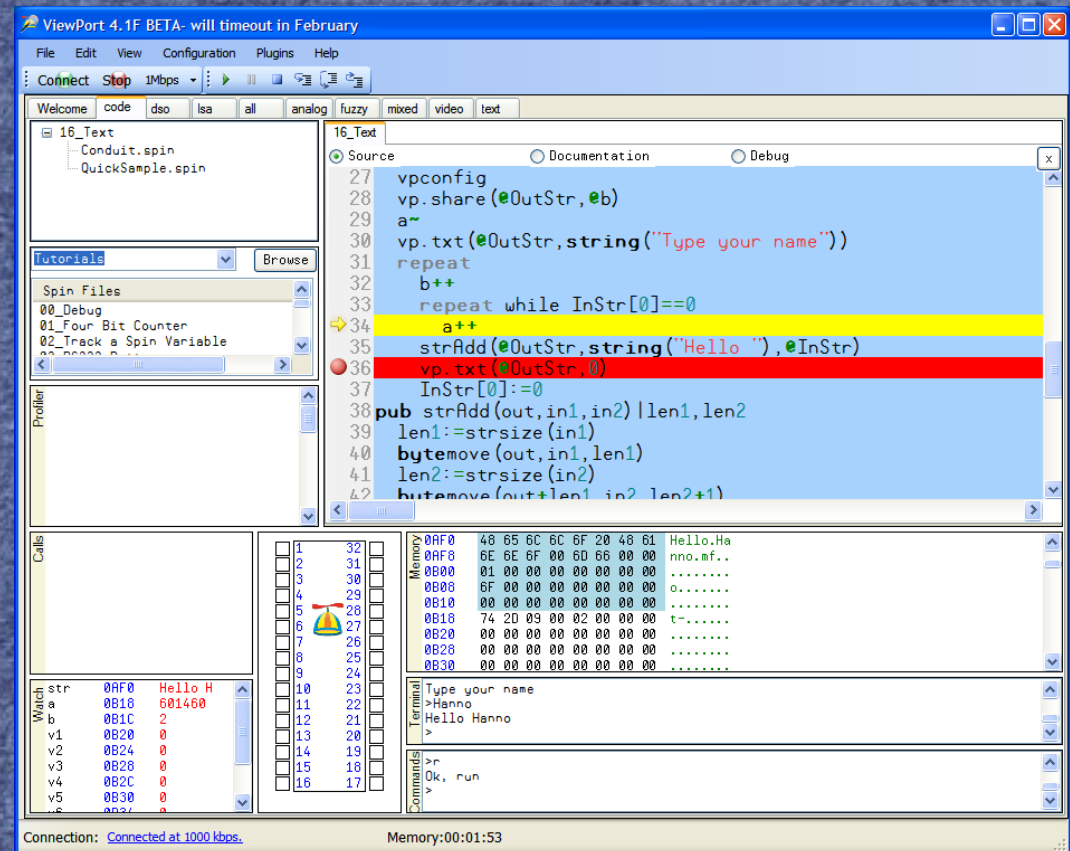
View Data

Change Data



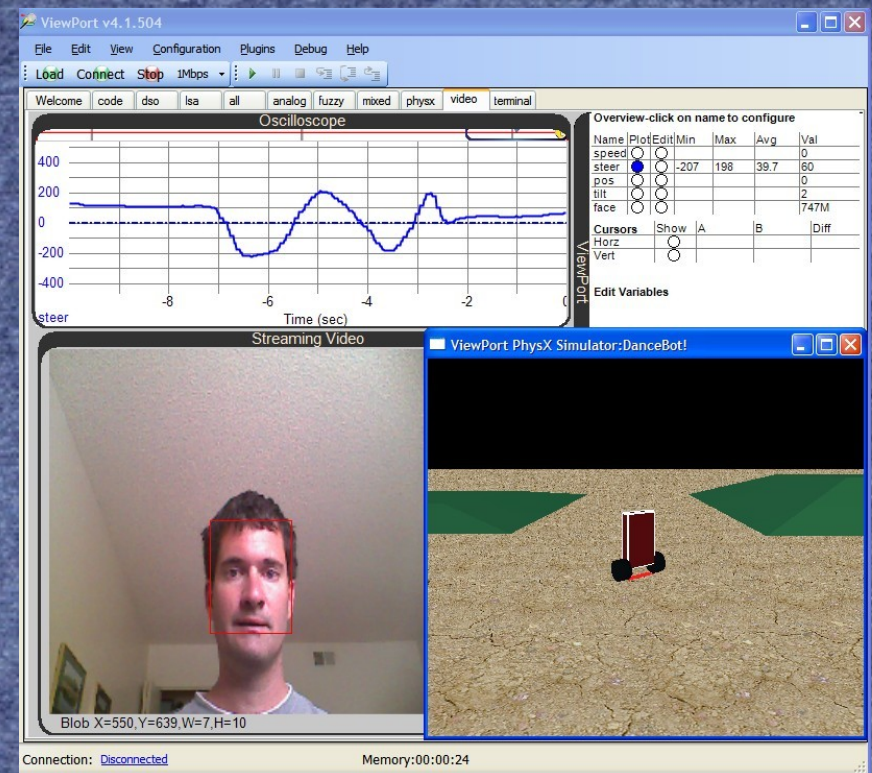
Demo #3: Spin Code Debugger

- Spin is C++ like language: **repeat, if, outa, x:=2**
- Integrated ViewPort Debugger includes:
 - Breakpoint
 - Pause
 - 3 types of Step
 - Profiler
 - Interpreter
 - Call stack
 - View Memory
 - View IO States



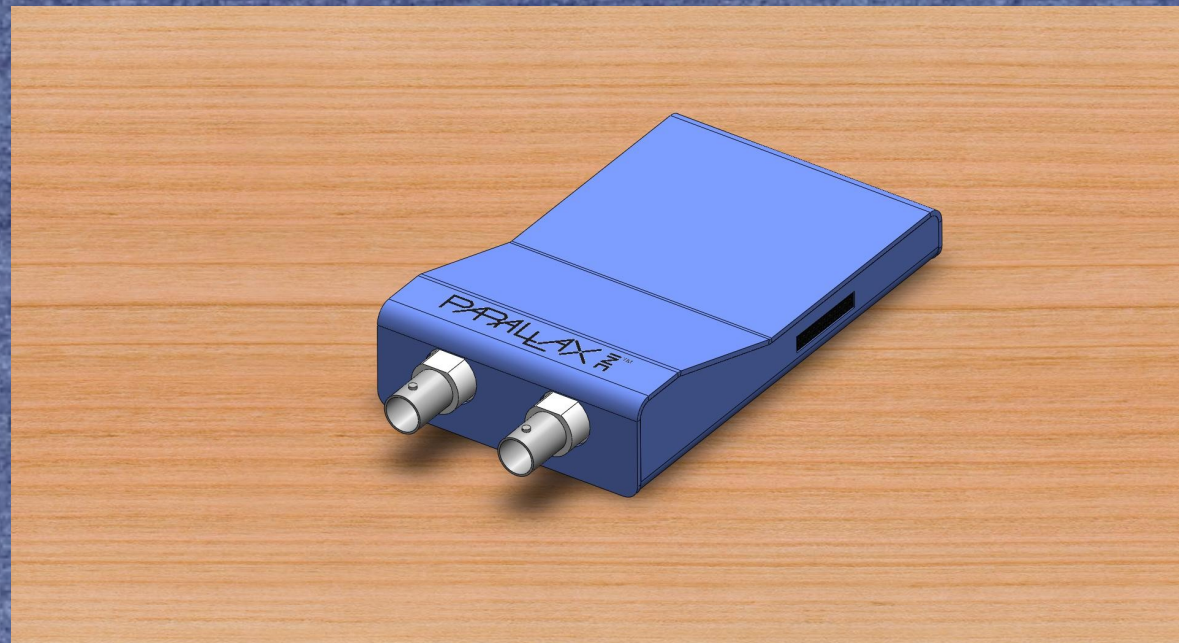
Demo #4: OpenCV/PhysX

- Simulated DanceBot, controlled by code on Propeller
- Nvidia PhysX: GPU-accelerated physics simulator: Friction, gravity, joints...
- Steered by Face location as found by OpenCV
- ViewPort is “glue” for 3 processors:
 - CUDA for physics
 - Propeller for control
 - CPU for OpenCV



PropScope

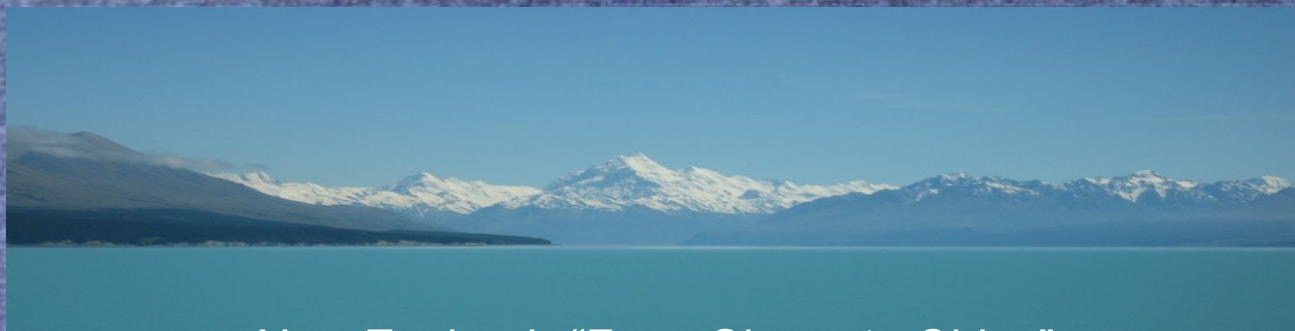
- Multi-function USB Oscilloscope/Function Generator/Logic Analyzer for \$199
- Retail Product by Parallax
- Powered by ViewPort library



Q&A



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New Zealand: *"From Sheep to Chips"*