Fast-Prototyping Using the BTnode Platform

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HW: BTnode rev3 Architecture Details

- **System core**
  - Atmel ATmega128
  - 256 kB SRAM
  - Generic IO/Peripherals
  - Switchable power supplies

- **Dual radio system**

- **Bluetooth radio**
  - 2.4 GHz Zeevo ZV4002

- **Low-power radio**
  - 433-915 MHz ISM Chipcon CC1000
HW: Connections

• Programming
  • In-System Programming, JTAG
  • Serial Bootloader, OTA using Bluetooth

• Interfaces
  • 15 pin Do-It-Yourself connector provides switchable power supply, UART, I2C, GPIO and ADC.
  • 40 pin Board-to-Board for custom applications

• Sensors:
  • TecO Sensor Board with Daylight + IR Light, Temperature, Microphone and 2D Acceleration
SW: Operation System Choice

- Basic TinyOS 2.x Platform Support (Jan Beutel)
  - ATmega128, 4KB RAM, Chipcon CC1000, LEDs working
  - more to come: full 256 KB SRAM, Bluetooth support

- BTnut System Software
  - Nut/OS
  - BTnode drivers
  - Bluetooth Stack
SW: BTnut - Nut/OS

- Built on top of multi-threaded Nut/OS
- Reliable and stable OS, large user base, used in commercial appliances (embedded networked systems, automation etc.)
- Features
  - Non-preemptive, cooperative multi-threading
  - Events, timers
  - POSIX style device drivers
  - Dynamic heap allocation
SW: BTnut - Bluetooth Stack

- HCI, L2CAP and RFCOMM layers implemented
- Communication with PC, Laptop, PDA, Mobile
- Remote Programming over BT supported
- JAWS Multi-hop Networking

=> Deployment-Support Networks
SW: BTnut - Support

- Web: Wiki, Tutorials, Docu, Demo apps, Mailing list
- Quality: Automatic build of BTnut system, example apps and documentation from CVS
- Development Support (aka Debugging):
  - Emulation of BTnut app with real or simulated BT modules
  - printf over serial port or BT RFCOMM (Multihop => next talk)
  - BTnut tracer records time stamped events (1 uS resolution)
BTnode Prototyping

- Standard tools and C language (avr-gcc toolchain)
- Reliable & tested OS and Drivers
- Direct communication with Mobile Phones, PDA, PCs
- Various debugging options (Emulation, Tracer, printf)
- Example Applications
BTnode Platform Success

• Industrial technology transfer
  • Commercialization with ETH spin-off “Art of Technology”
  • Commercial replicas resulting from open source policy
• BTnodes in Education
  • Different labs and demos
  • Graduate lab in embedded systems (120 participants)
  • 30-40 successfully completed student projects
• BTnodes in Research Domains
  • 25+ wearable and ubiquitous computing applications and demos
  • Wireless (sensor) network research
  • 40+ scientific publications based on or related to BTnodes
To probe further...

http://www.btnode.ethz.ch