

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

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

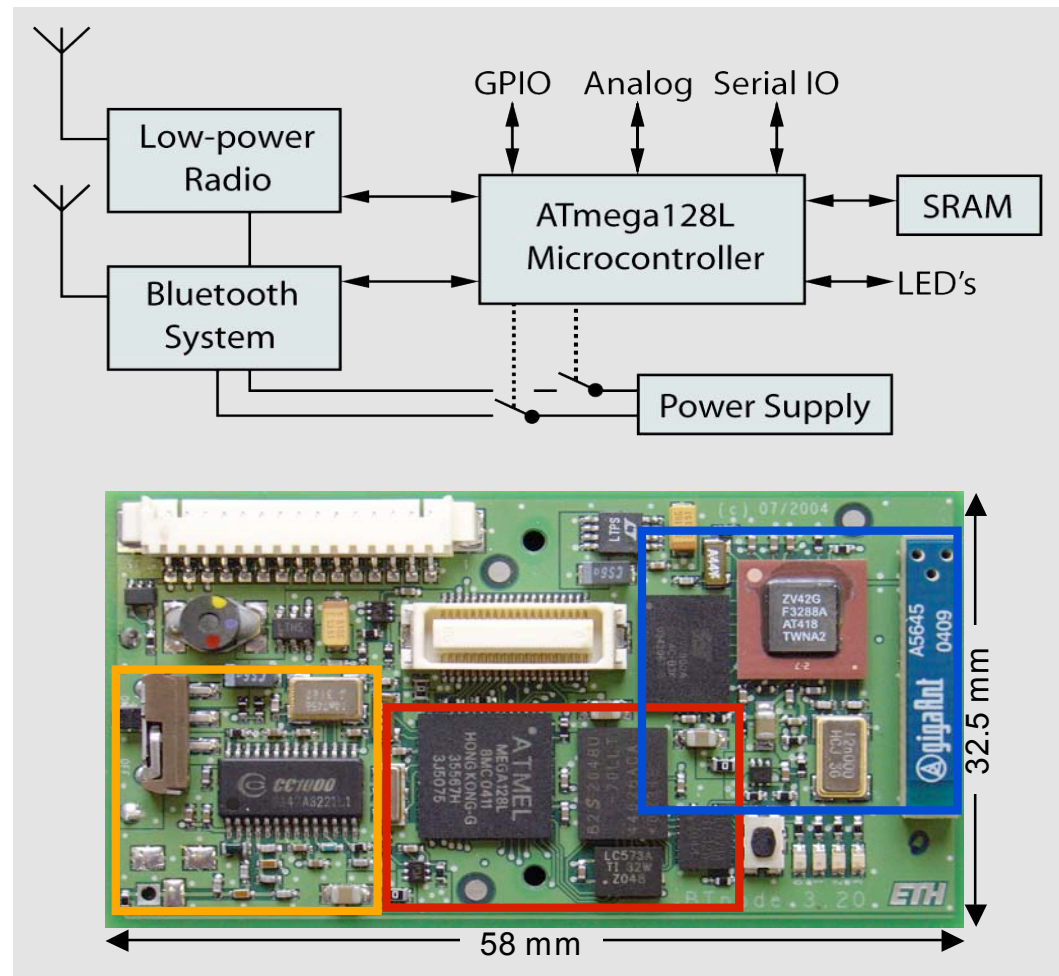
Dual radio system

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



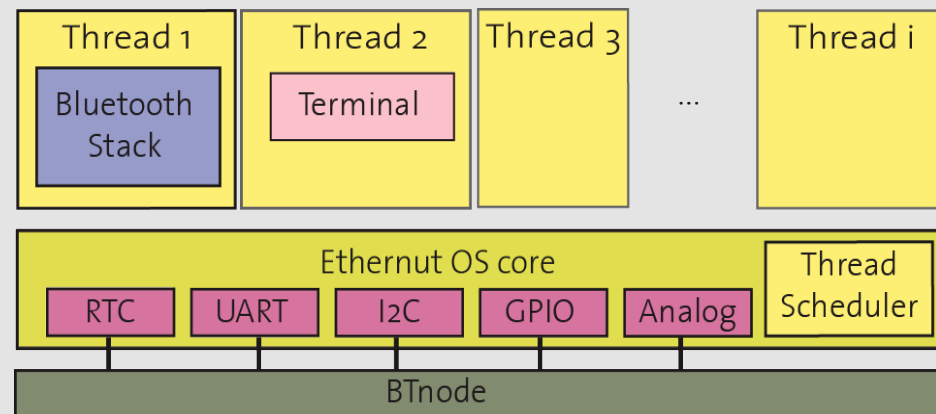
USB Prog Board
TecO Sensor

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

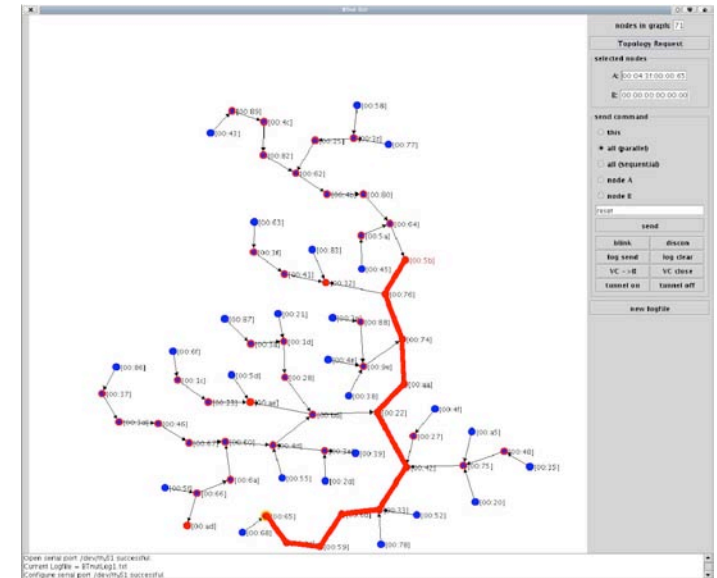
SW: BTnut - Nut/OS

- 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



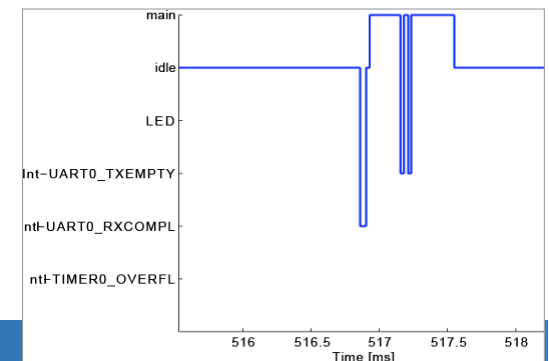
SW: BTnut - Bluetooth Stack

- 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)

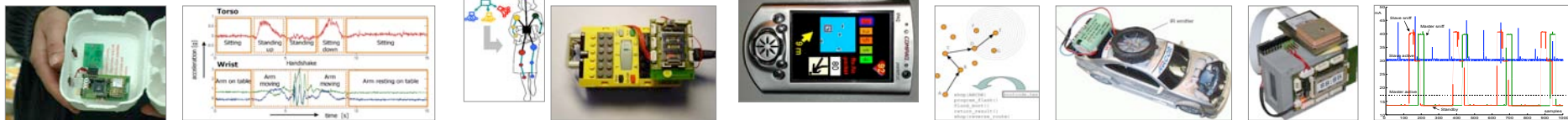
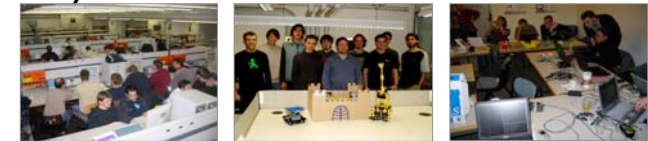


BTnode Prototyping

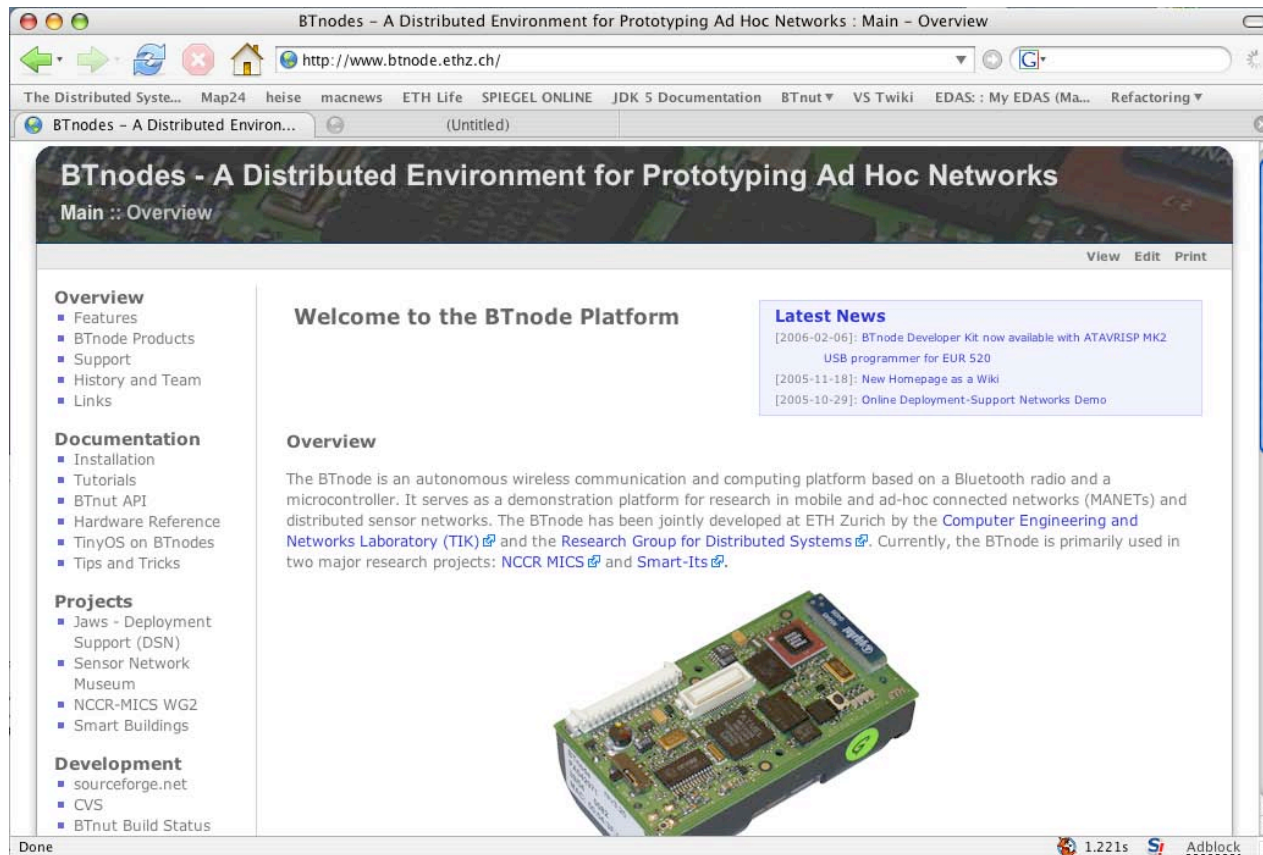
- Standard tools and C language (avr-gcc toolchain)
- Reliable & tested OS and Drivers
- Direct communication with Mobile Phones, PDA, PCs
- Various debugging options (Emulation, Tracer, printf)
- Example Applications

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...



The screenshot shows a web browser window displaying the main overview page of the BTnodes project. The browser's address bar shows the URL <http://www.btnode.ethz.ch/>. The page title is "BTnodes - A Distributed Environment for Prototyping Ad Hoc Networks : Main - Overview". The page content includes a navigation menu on the left with sections for Overview, Documentation, Projects, and Development. The main content area features a "Welcome to the BTnode Platform" section, a "Latest News" box with three entries, and an "Overview" section describing the platform's purpose and development. A photograph of a BTnode hardware board is shown at the bottom right of the main content area.

Overview

- Features
- BTnode Products
- Support
- History and Team
- Links

Documentation

- Installation
- Tutorials
- BTnut API
- Hardware Reference
- TinyOS on BTnodes
- Tips and Tricks

Projects

- Jaws - Deployment Support (DSN)
- Sensor Network Museum
- NCCR-MICS WG2
- Smart Buildings

Development

- sourceforge.net
- CVS
- BTnut Build Status


Welcome to the BTnode Platform

Latest News

- [2006-02-06]: BTnode Developer Kit now available with ATAVRISP MK2 USB programmer for EUR 520
- [2005-11-18]: New Homepage as a Wiki
- [2005-10-29]: Online Deployment-Support Networks Demo

Overview

The BTnode is an autonomous wireless communication and computing platform based on a Bluetooth radio and a microcontroller. It serves as a demonstration platform for research in mobile and ad-hoc connected networks (MANETs) and distributed sensor networks. The BTnode has been jointly developed at ETH Zurich by the [Computer Engineering and Networks Laboratory \(TIK\)](#) and the [Research Group for Distributed Systems](#). Currently, the BTnode is primarily used in two major research projects: [NCCR MICS](#) and [Smart-Its](#).



<http://www.btnode.ethz.ch>