CORE-TX

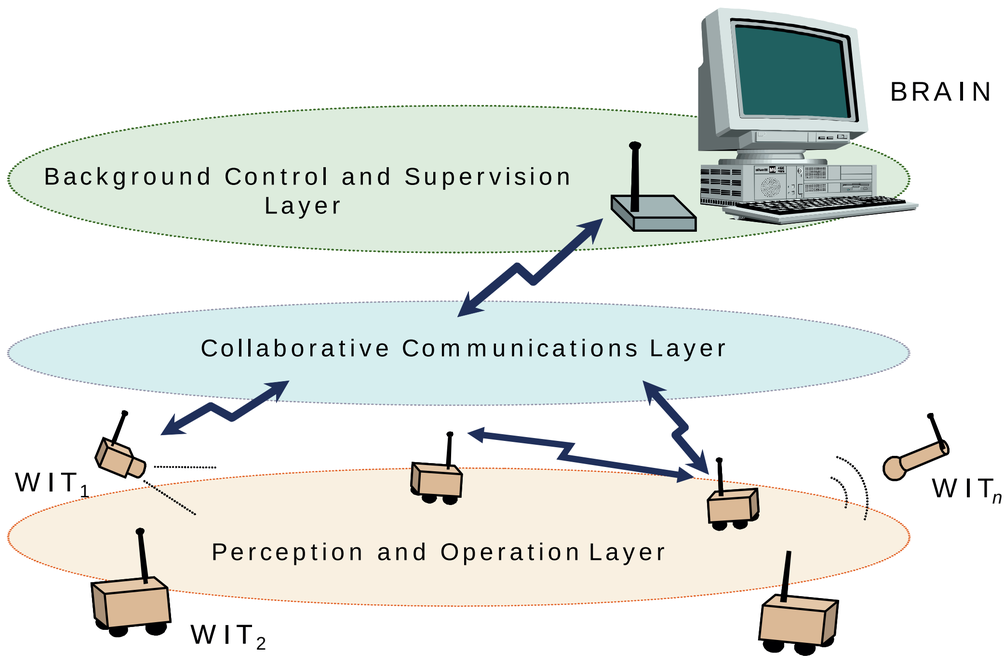
COllaborative Robotic Environment – the Timisoara eXperiment

Mihai V. MICEA, Vladimir I. CREȚU, Dan CHICIUDEAN, Răzvan D. CIOARGĂ, Bogdan STRATULAT, Cristina STÂNGACIU, Valentin STÂNGACIU, Gabriel CÂRSTOIU, Lucian UNGUREAN, Andrei STANCOVICI

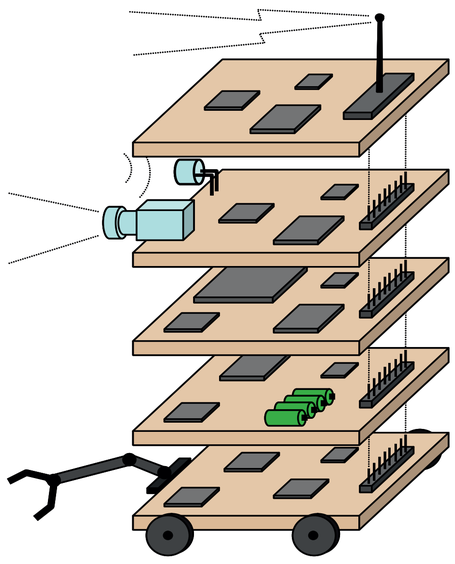
Overview

- Complex platform:
  - Studies on real-time autonomous microsystems with embedded intelligence
  - Applications of distributed artificial perception, intelligent sensor networks and collaborative robotic environments
- General architecture:
  - Perception and Operation Layer: set of autonomous microsystems with embedded intelligence (WITs)
  - Collaborative Communications Layer: based on the ZigBee wireless protocol
  - Background Control and Supervision Layer: central entity in charge of overall system configuration, control, data gathering and user interface (BRAIN)

CORE-TX General Architecture



General Architecture of the WIT



COM: Communication Module (daughterboard)

SEM: Perception (Sensor) Module (daughterboard)

BAM: Base Processing Module (motherboard)

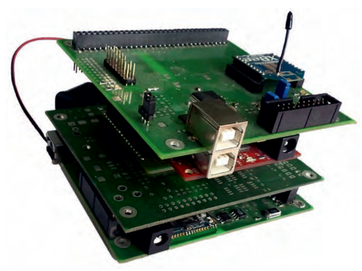
POM: Power Management Module (daughterboard)

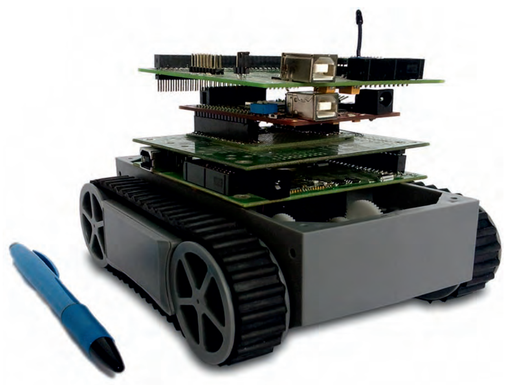
ROM: Support and Operation (Robotic) Module (daughterboard)

Perception and Operation: WIT

- WIT (Wireless Intelligent Terminal):
  - Perception (intelligent sensors) and/or operation (autonomous mini-robots)
  - Data communication capabilities (IEEE 802.15.4 “ZigBee” wireless protocol)
- General architecture:
  - Modular approach: 1 motherboard + up to 7 daughterboards
  - Board interconnection: PARSECS (Predictable Architecture for Sensor Communication Systems) → SPI bus in master-slave configuration
  - Base Processing Module, BAM (motherboard): central processing unit of the WIT; ARM9 based architecture; runs under the QNX® Neutrino® RTOS
  - Daughterboards: specialized functions (ROM, POM, SEM, COM); ARM7 based architecture; run under the HARETICK (Hard Real-Time Compact Kernel, http://dsplabs.cs.upt.ro/grants/openharts/) ⇒ highly predictable operation

Prototype Versions of a Static WIT and a Mobile WIT

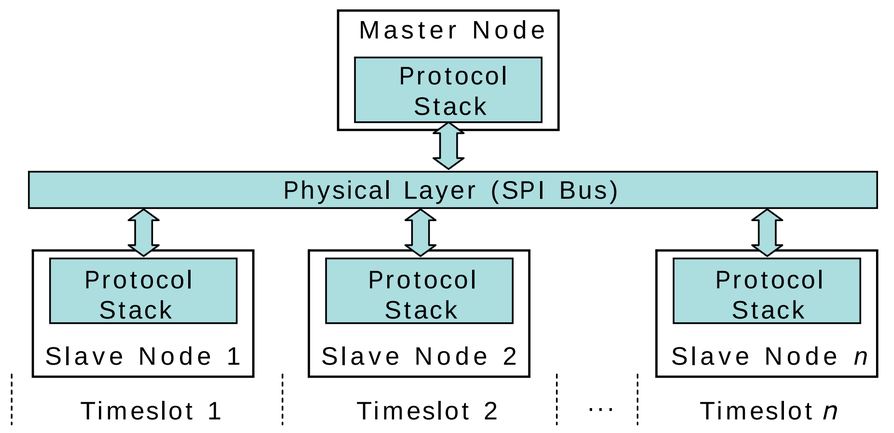


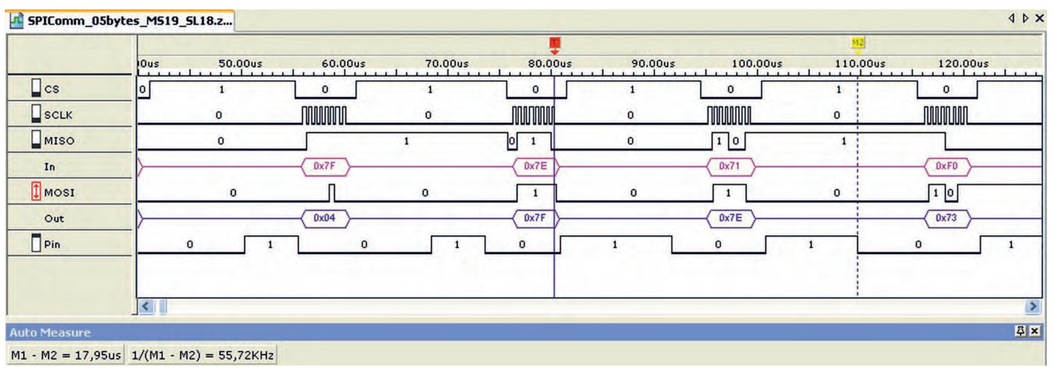


Background Control and Supervision: BRAIN

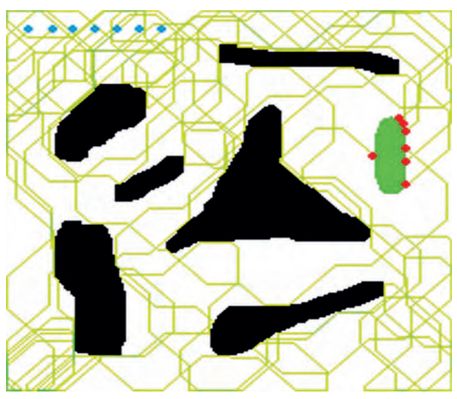
- BRAIN (Background Robotic Activity Induction Node):
  - Host computer with communication support
  - Reconfiguration/autoconfiguration of the collaborative environment
  - Development and analysis of behavior patterns
  - eBML - emergent Behavior Modeling Language
  - eBMS - emergent Behavior Modeling Simulator
  - General coordination → "background induction” techniques
  - Network data query, aggregation and analysis
  - Graphical user interface, configuration and status reports

PARSECS: Architecture and a Master-Slave Data Exchange Caption





eBMS Simulation of an Environment Exploration and Resource Gathering Application



: Start point of mobile WIT
: Resource
: Finish point of mobile WIT
: WIT movement trace
: Obstacle

Results

- 22+ papers published in scientific journals, periodicals and at conferences
- 1 major follow-up R&D grant (http://dsplabs.cs.upt.ro/grants/melissevs/)
- 3 operating WIT prototypes, in minimal architecture (BAM + POM + COM)
- Specifications of the eBML language and case study applications
- Prototype of the eBMS simulator and use case studies
- Studies and applications: wireless connectivity assessment and improvement; HARETICK kernel performance tests; BRAIN level data aggregation techniques

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