Sensor ans Self-Organized Networks

http://www/lifl.fr/sensor
Outlines

I. Internet of things and Wireless Sensor Networks

II. RECAP platform
Outlines

I. Internet of things and Wireless Sensor Networks

II. RECAP platform
RFID Tags

- Smart labels
  - Radio Frequency Identification Tag
  - By opposition to bar code which use optical principles

- A strongly limited component:
  - 500 times smaller than a classical

Chip with a size of some mm²
EAS Application

- Electronic Article Surveillance
  - Once powered, the tag emits
  - The reader listen channel and activate alarm as early as transmission is detected
  - During checkout, the tag is burned out

- Problem: power and hear the tag whatever the tag orientation
Applications

- Batch identification
  - It is the capability to collect information from a set of tags
  - In opposition to optical identification

Marathon
Automatic clocking in

Automatic luggage sorting

Automatic inventory
50 items in less than one second
More POPS, smaller POPS…

POPS = Portable Objects Proved to be Safe
POPS = Petits Objets Portables et Sécurisés

Courtesy, Alien Technology
The MIT Auto-ID Center Vision of “the internet of things”
Networking the physical world

RF Tag

Networked Tag Readers

Savant Control System
Auto-ID Center classification

Class V tags
Readers. Can power other Class I, II and III tags; Communicate with Classes IV and V.

Class IV tags:
Active tags with broad-band peer-to-peer communication

Class III tags:
semi-passive RFID tags

Class II tags:
passive tags with additional functionality

Class 0/Class I:
read-only passive tags
Benefits of class IV tags

- Decentralized behavior
  - The request is broadcasted in the whole network by using multi-hop method
- Similar to sensor networks
Sensor Nets for Search and Rescue

- Inactive Sensor
Sensor Nets for Search and Rescue
Sensor Nets for Search and Rescue

• Active Sensor
Application

- In the UC Berkeley Botanical Garden, 50 “micromotes” sensors are dangled like earrings from the branches of 3 redwood trees to monitor their growth.
Event-driven model
On-demand model

1. Request using flooding
2. Report using multi-hop and tree structure

Monitored Area
Monitoring Station (sink)
3. Report
WASP Project

Wirelessly Accessible Sensor Populations

Philips Research Eindhoven, Philips Forschung Laboratorium, IMEC, CSEM, TU/e, Microsoft Aachen, Health Telematic Network, Fraunhofer IIS, Fokus, IGD, Wageningen UR, Imperial College London, STMicroelectronics, INRIA, Ecole Polytechnique Federale Lausanne, Cefriel, Centro Ricerce Fiat, Malaerdalen University, RWTH Aachen, SAP, Univ of Paderborn
SVP Project

Surveiller et Prévenir

CEA, INRIA, Institut Maupertuis, Aphycare, LIP6, M2S, Thales, ANACT
Experiments

Ceinture POLAR pour la mesure ambulatoire de la FC

5 capteurs Séréo'Z sans fil

VO2000 : Mesure ambulatoire des échanges gazeux

Un Anthony motivé par la recherche !

Tapis déroulant
Vélo à effort paramétrable
Sac à dos chargé
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CNRS RECAP Platform

- **RECAP = REseaux de CAPteurs**
  - Initially funded by CNRS in 2005
  - National CNRS Platform
    - 9 partners
  - Focus on platforms

- **Public workshops**
  - Coming event: Toulouse November 13-14, 2008!

  - More information: http://www.sensslab.info
Partners

- CITI, INSA Lyon, ARES INRIA Rhône-Alpes (Eric Fleury)
- CRAN, Nancy (Vincent Lecuire)
- IRISA, INRIA, CNRS, Univ. Rennes 1, INSA Rennes (Patrice Quinton)
- LAAS, Toulouse (Michel Diaz)
- LIFL, Univ. Lille 1, POPS INRIA Futurs (David Simplot-Ryl)
- LIP6, Univ. Pierre et Marie Curie, Paris (Serge Fdida)
- LIUPPA, Univ. Pau et des Pays de l’Adour (CongDuc Pham)
- LSIIT, Univ. Louis Pasteur, Strasbourg (Thomas Noël)
- LSR, IMAG, Grenoble (Andrzej Duda)
Hardware platforms – first phase

- 3 different platforms

- Motes
  - ~90 nodes
  - Experimentations with TinyOS and SOS
  - Dynamic graph application in Paris and Lille

- Mini-PC
  - ~36 nodes
  - Non-constrained platforms for small scale experimentations
  - Mesh networks in Lyon and Paris

- FPGA Platform
  - ~4 development platforms
  - Core ARM+FPGA dedicated to
    - Hardware-software interface Lille and Lyon
Hard/soft interface in wireless communications

- In partnership with IEMN
  - Research institute in microelectronic area
- High rate communication interface for indoor communications
  - 60 GHz UWB 100 Mb/s
    - Contention free
    - Directional antennas
  - Use of a low rate (12 Mb/s) control channel
    - Random access (variation of CSMA/CA)
    - Omnidirectional reception
    - Directional emission
- Some challenges
  - Combination of packet scheduling and topology control
  - Beam switching and reduction of energy consumption
Hardware platform – 2\textsuperscript{nd} phase

- Open large scale experimentation platform
  - 4 locations avec 4 different scenarios
    - Number of nodes
    - Topology
    - Mobility?
  - At least 250 nodes per location
  - Applications, network configuration and experimental results available via Internet
    - Experimentation with nodes in a single site
    - Experimentation with nodes in several sites connected via Internet (second phase)
SensLab: very large open wireless sensor network testbed

- Funded by ANR - http://www.senslab.info
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