RFID tags for ambient intelligence: present solutions and future challenges

Presentation Outline

• Smart devices program at LETI
• Overview of RFID
  – Basic principles
  – Regulation issues
  – Performance & cost
• RFID and AmI
  – Business models and scenarios
  – Future challenges
  – Privacy issues
Leti: activities, facts & figures

- 160 M€ yearly revenues
- 44 M€ investment
- 70% from contractual resources
- > 150 patents in 2004
- 900 CEA employees
- 570 hosted scientists

Systems for biology & health

Systems for communications

Technologies for miniaturization

- 60% Silicon microelectronics
- 20% Silicon microsystems

Components for optronics

- 20%

Spread of electronic functions
Basic principles of RFID

- **Inductive coupling**
  - Magnetic field (near field) 13.56 MHz
  - Antenna = Coil

- **Electric coupling**
  - Electric field (Far field) at 868 MHz, 2.45 GHz
  - Antenna = wired or planar

**2 elementary functions**

1- **Power Transfer**
2- **Bi-directional data transfer**

Regulation issues

- **Contactless Cards**: frequency 13.56 MHz, format of support: credit card
  - ISO/IEC 10536: « Close coupling Contactless Cards »: remove contacts
  - ISO/IEC 14443: « Proximity Coupling Contactless Card »: Ticketing, Credit cards,
  - ISO/IEC 15693: « Vicinity Coupling Contactless Card »: Access control

- **Item management standards**: « Automatic Identification – Radio Frequency Identification for Item Management»
  - ISO/IEC 18000-2: below 135 kHz
  - ISO/IEC 18000-3: at 13.56 MHz
  - ISO/IEC 18000-4: at 2.45 GHz
  - ISO/IEC 18000-5: at 5.8 GHz
  - ISO/IEC 18000-6: at UHF

- **Test & Conformance standards**:
  - ISO/IEC 10373: Test and Conformance methodology
  - ISO/IEC 18046: Test for conformance methodology
  - ISO/IEC 18047: Test for performance methodology
Performance & cost

- Reading distance
- Anticollision
- Data rate
- Cost
  - silicon die
  - antenna
  - tag materials
  - assembly

DAG Systems for sport competition

Alien microfluidic assembly technology

RFID and Aml

Smart accessory
Memory
Datalogger

Battery powered sensor (BPS)

Selected BPS

Wireless remote powered sensor (WRPS, selected)

Cellular Network

Services communication

User Interface to Al

Cellular Engine

IP Network

Applications

Embedded sensors

Short range radio

User Interface to Al

Cellular Engine

Applications

Embedded sensors

Short range radio
RFID and Aml

Leading world patents holders

Privacy issues

What are people afraid of?

- Tag reading without the user consent and/or awareness
- Every device is traced (unique code for each product)
- Association between the object (+ the owner?!) and a data basis

Risks

- Spam like strategies
- Spying of consumer behavior
- Refusal of rfid by consumer groups

Source: CEA-LETI O Savry
Privacy issues

The “Kill Tag” approach

The Faraday Cage approach

mobilecloak.com

The Active Jamming Approach

The “Smart” RFID Tag Approach

The “HashLock” approach (Weis & al)
The reencryption approach (Juels and Pappu, Golle & Al)
Silent TreeWalking (Weis & al – reader encryption)

The Regulation Approach

Source: The Blocker Tag: Selective Blocking of RFID Tags for Consumer Privacy
Ari Juels, Ronald R Rivest, Michael Szydlo

Blocker tags

The approach is based on singulation & tree walking protocols

The blocker tags (two antennas) broadcast simultaneously a 0 & a 1 at each node of the tree (full blocker) or specific nodes (partial blocker) and forces the reader to explore large amounts of branches ( \( \gg 2^{64} \)).

Source: The Blocker Tag: Selective Blocking of RFID Tags for Consumer Privacy
Ari Juels, Ronald R Rivest, Michael Szydlo
Privacy issues

- Use of a specific device to unable communications between the tag and the reader.

Thank you for your attention