WiSe-Nodes: A family of node prototypes for wireless sensor networks

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Outline

• Introduction
• Architecture
• WASP: Wireless Asynchronous Simple Protocol
• Design tests
• Conclusions and further work
What is a Wireless Sensor Network (WSN)?

- **Sensor:**
  - A transducer
  - Converts physical phenomenon e.g. heat, light, motion, vibration, and sound into electrical signals

- **Sensor node:**
  - Basic unit in a sensor network
  - Sensors, processor, memory, transceiver, and power supply

- **Sensor network:**
  - Large number of sensor nodes
  - Nodes deployed either inside or very close to the sensed phenomenon
WSN: Application examples

- Military applications
- Environmental applications
- Health applications
- Home and office applications
- Automotive applications
Military applications (examples)

- Monitoring equipment.
- Surveillance.
- Targeting
- Detection
  - Nuclear
  - Biological
  - Chemical attack
  - Etc.
Environmental applications

- Forest fire detection
- Flood detection
- Air/water pollution
Home applications (examples)

- Home/office automation.
- Smart environments.
WSN: Application examples

Automotive applications
Parameters on WSN design

- Scalability
- Fault tolerance
- Power consumption
- Topology
- Environment
WSN’s characteristics

- One or more sink nodes.
- No direct connection to the sink node
  - Forward
  - Routing
- Shared medium (wireless)
  - MAC protocol.
Examples of commercial sensor nodes

- **Motes**
  - UC Berkeley

- **Btnodes**
  - ETH Zürich

- **Scatterweb**
  - Freie Universität

- **EYES**
  - Infineon
Commercial WSN nodes: advantages and disadvantages

- **Advantages**
  - They implement the basic function of a WSN node.
  - Optimized design.

- **Disadvantages**
  - Expensive
  - Sometimes difficult to extend

- So, it is desirable to account with a *benchmark* to implement a WSN node

  So, we build WiSe-Nodes
WiSe-nodes architecture

WiSe-nodes’ functions:
- Send/receive data packets.
- Send/receive forward sensor data.
- Send/receive ctrl packets (MAC & routing)
Components of a WiSe-Node

- **Processor unit**
  - Two *Microchip* PIC16F877A microcontrollers.
    - F-Microcontroller (transceiver interface)
    - H-Microcontroller (hybrid routing and MAC protocol)

- **Two different transceivers**
  - *Chipcon* CC1000PP-868
  - Raw RF transceiver: TWS-BS and RWS-374
WASP: Wireless Asynchronous Simple Protocol

- **WASP**: Implements MAC and routing.
- **Goal**: Collect sensor data and send data to the head node (h) of the WSN.

**Collecting data:**
- h builds a tree.
- h is the head of the tree.
- Tree is built by using a token.

**Two stages:**
- Adoption process
- Tree maintenance

**Each node implements WASP**
## WiSe-Nodes: Types of tests

<table>
<thead>
<tr>
<th>Topology</th>
<th>Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>h node and two childrens</td>
<td>Consistency of WASP</td>
</tr>
<tr>
<td>h node → child → child</td>
<td>Idem: Data collected by the head node</td>
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</tbody>
</table>
Conclusions

- **WiSe-Nodes**: general architecture to build a wireless sensor node.
- A *testbed* to implement new wireless sensor network protocols.
- Architecture based on the PIC16f877 microcontroller.
- WiSe-nodes are about 60% less expensive than commercial nodes for WSNs.

**Further work:**
- Port our code to Amtel AVRs.
- Use light, rotation and vibration sensors.
Thanks! Merci !