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

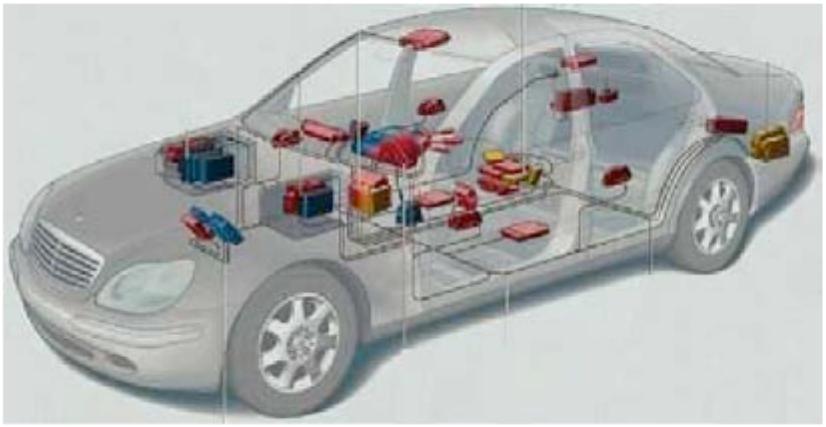
- Forest fire detection
- Flood detection
- Air/water pollution

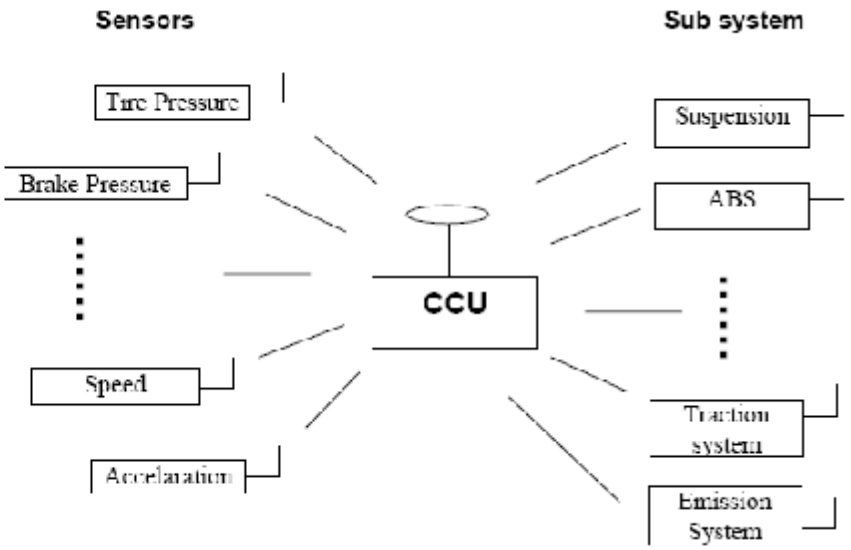
Home applications (examples)

- Home/office automation.
- Smart environments.

WSN: Application examples

Automotive applications





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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 Universitat
- EYES
  - Infineon

Commercial WSN nodes: advantages and disadvantages

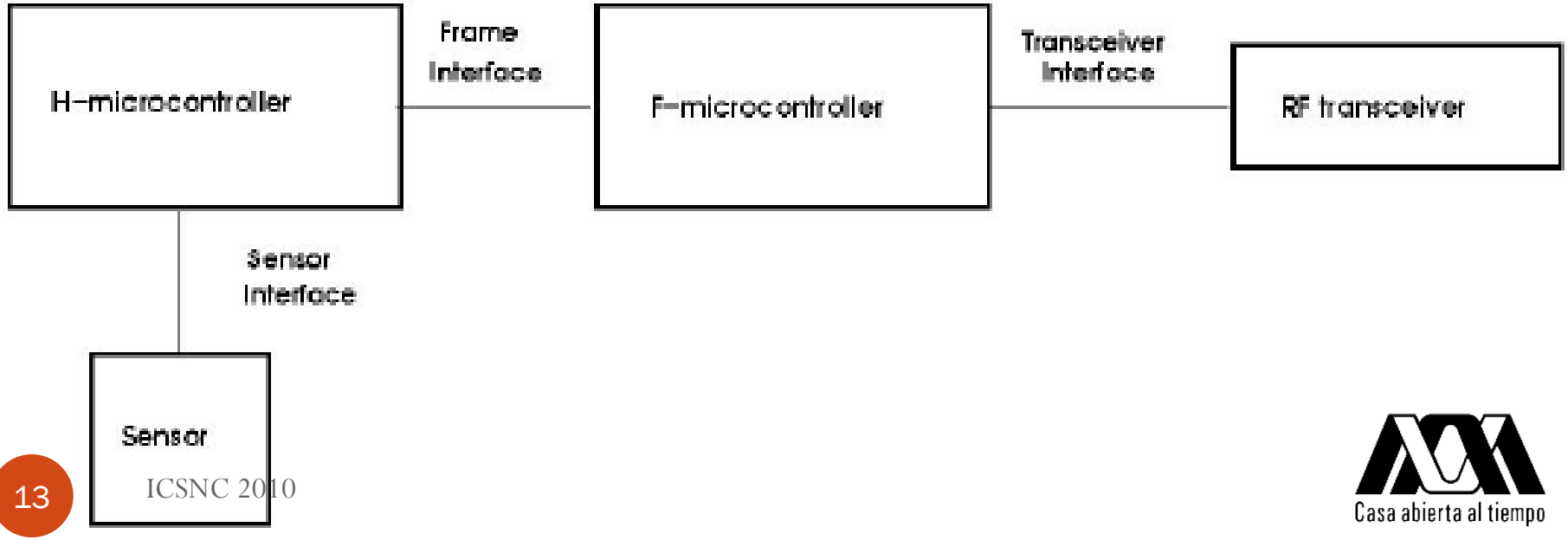
- **Advantages**
  - They implement the basic function of a WSN node.
  - Optimized design.
- **Disadvantages**
  - Expensive
  - Sometimes difficult to extend
- So, it is desirable to account with a ***benchmark*** to implement a WSN node

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)



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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

Topology	Test
h node and two childrens	Consistency of WASP
h node → child → child	Idem: Data collected by the head node

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 !