Low-Cost Energy-Autonomous Sensor Nodes Through RF Energy Harvesting and Printed Technology

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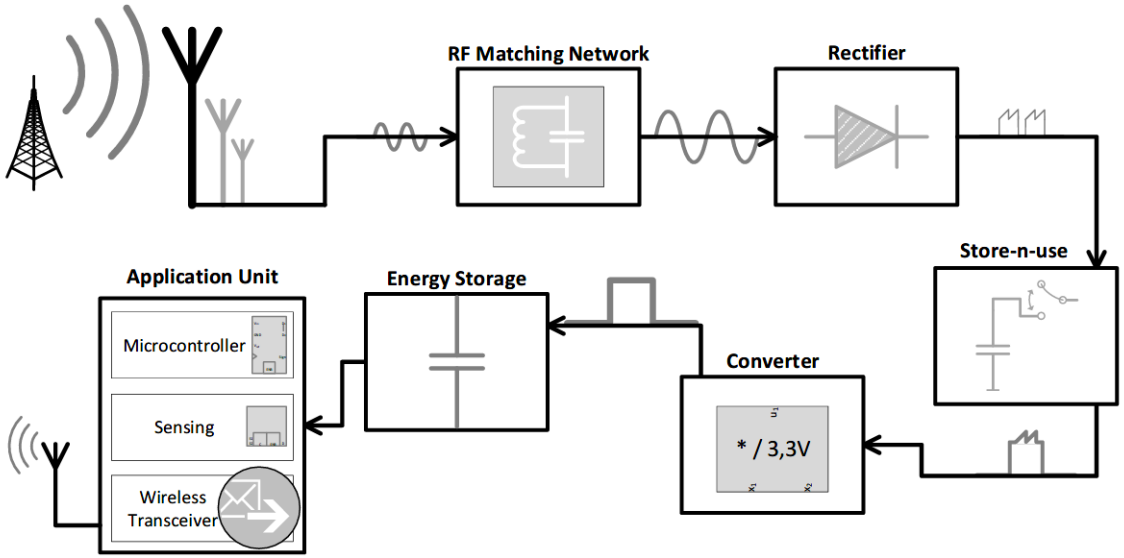
Agenda

Background

RF Energy Harvesting

- Far field region of RF signals → to → dc for IoT use
- Pros
  - Predictability and stability over time
  - Everywhere and every-time
  - Wireless nature
  - Low-cost and small size
- Cons
  - Available energy categorized as “ultra-low power“

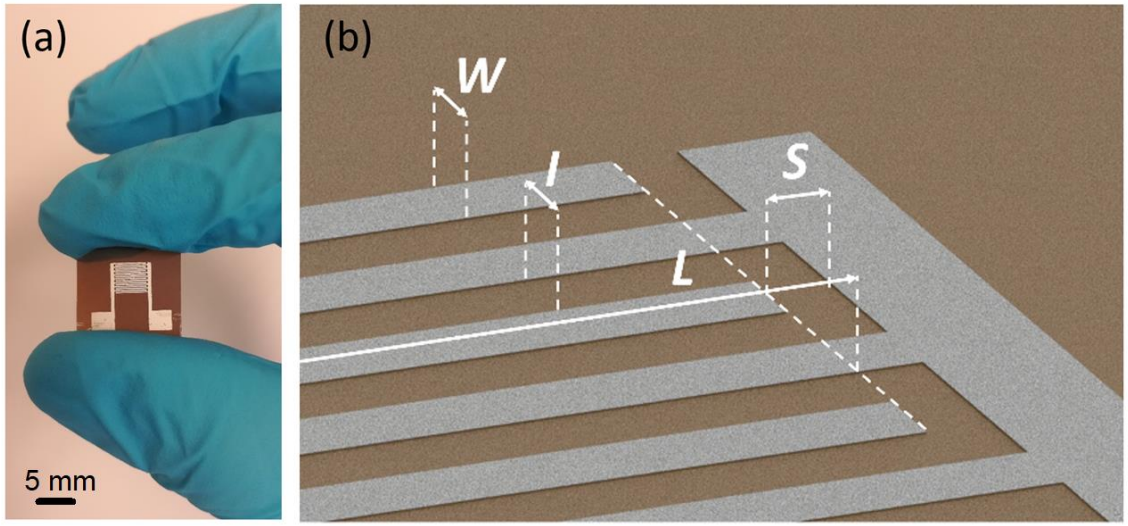
- Proposed logic diagram



Flexible Electronics Technology

- Diverse methods:
  - Screen- & inkjet-printing
  - Spray deposition
  - Laser processing
  - Hybrid technologies

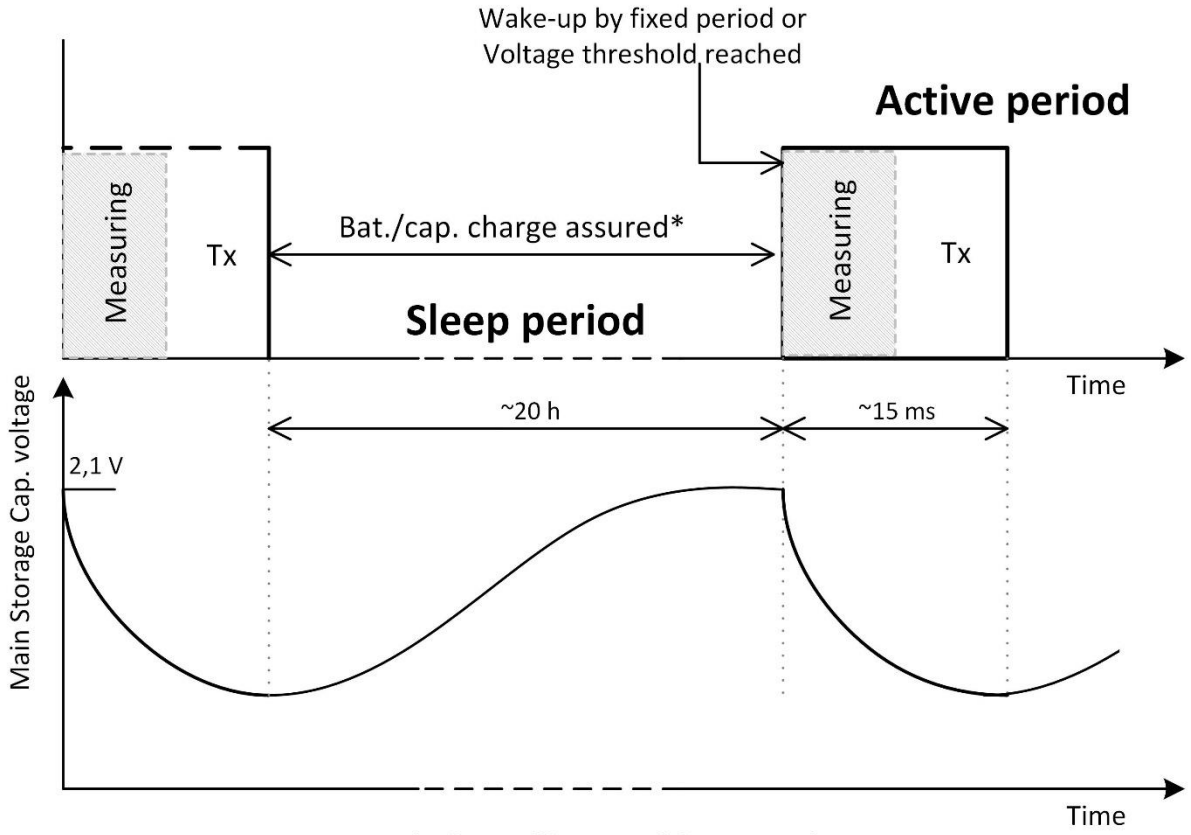
- Besides its inherent properties (flexibility, lightness, transparency, etc.)
  → Reduction of manufacturing & integration costs



Energy-Autonomous and Low-Cost IoT Nodes

Working Principle

› Duty-cycled operation



Example for Office Building Application

Harvested Energy

- Power levels in city open-spaces: [-30, -20] dBm
  - Active emitting: -3 dBm

- Not enough for state-of-the-art converters → **Store-and-use principle**

Harvested Energy

- Power levels in city open-spaces: [-30, -20] dBm
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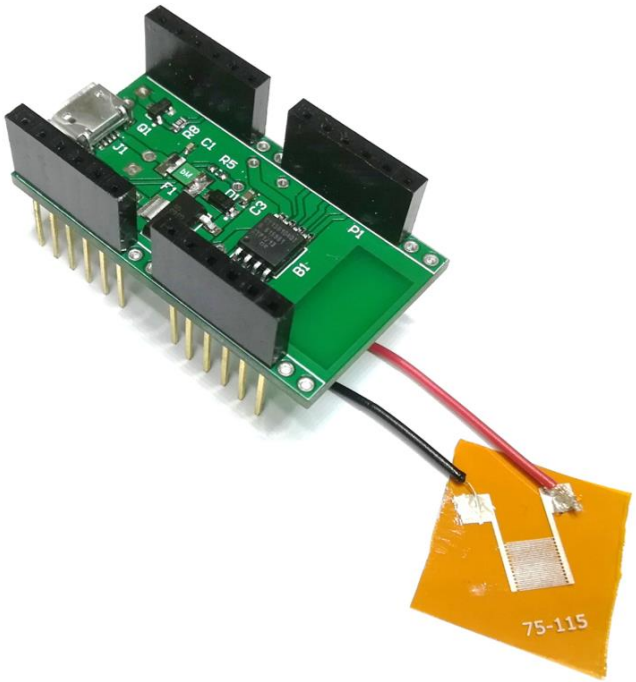
- Battery-less block:
  - RFEH
  - Based on switched capacitor
  - Adaption for dc/dc converters
  - Few to hundreds µW

Flexible Relative Humidity Sensor

Design:

- PET substrate coated with GO thin-layer
  - Concentration of 0.4 wt%
  - Manual airbrush of substrate (38.5 µL/cm²)
- Capacitive structure of 16 screen-printed IDE on its surface with silver-based conductive ink



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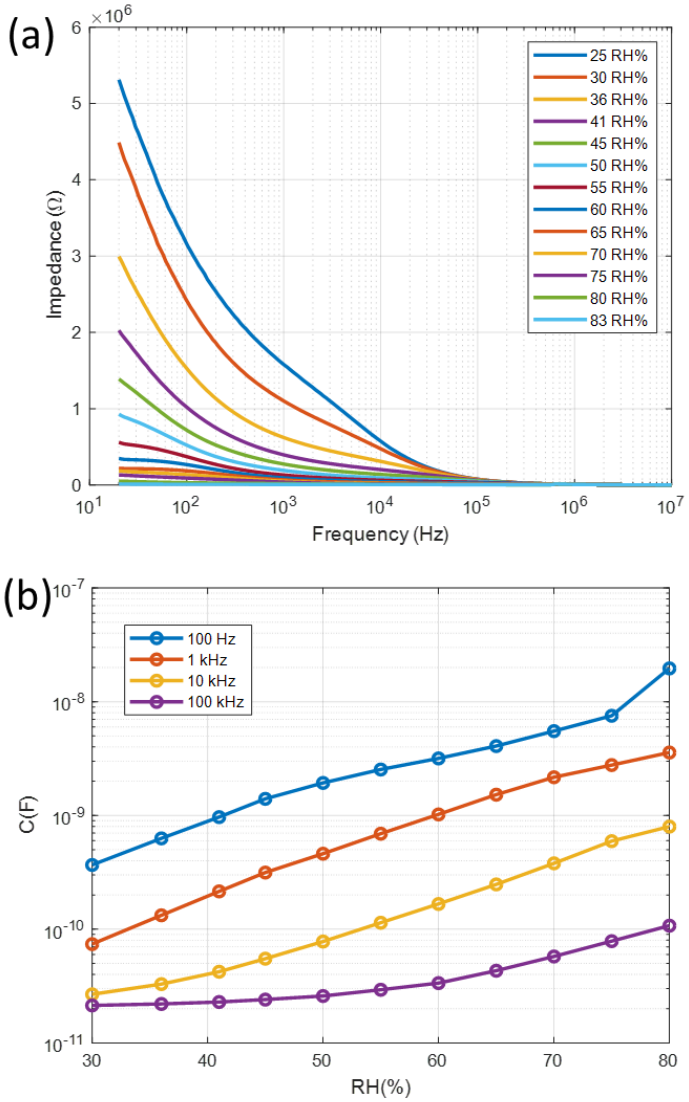

Impedance response of the sensor

Conclusion & Acknowledgment

Conclusion

Conjuntion use of RFEH & flexible printed sensors:

- No batteries
- No wires
- Easier manufacturing and integration
- Flexibility, lightness, transparency...
- Cheaper BOM

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→ Reduction of costs

Contact

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