Home Area Sensor Network based on Bluetooth Technology

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Workshop
Bluetooth: Current and Future Perspectives

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Wireless Short Range / LPWAN / Cellular

LAN/HAN ✓
Short Range
Communicating Devices

ZigBee · Bluetooth 4.0 · WiFi

✓ **Well established standards**

✓ **Good for:**
- Mobile devices
- In-home
- Short range
- Low cost

❑ **Not good:**
- Short range

Lo Power WAN ❓
Long Range w/ Battery
Internet of Objects
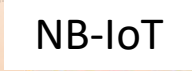
LoRa™ · SIGFOX · NB-IoT

✓ **Emerging PHY solutions**
✓
✓ **Good for:**
- Long range
- Long battery
- Low cost (*)

❑ **Not good:**
- Low data-rate

Cellular ✓
Long Range w/Power
Traditional M2M

3G+ / H+ · GSM · 4G

✓ **Well established standards**

✓ **Good for:**
- Long range
- High data-rate
- Coverage

❑ **Not good:**
- Low Battery life
- Higher Cost

Source: Semtech

HAN Technologies Comparison

Technology	Pros	Cons
Wi-Fi	Very high bitrate PC/Phone interoperability Massive deployed base	High consumption, battery constrains
BLE	Very low power PC/Phone interoperability Massive deployed base	Lower range (TxPower: 4 dBm), could require mesh.
Zigbee	Very low power	No PC/Phone interoperability Complex mesh network
PLC (HomePlug)	Very high bitrate	Requires Power plug availability

HAN Services/Applications

https://www.alzashop.com
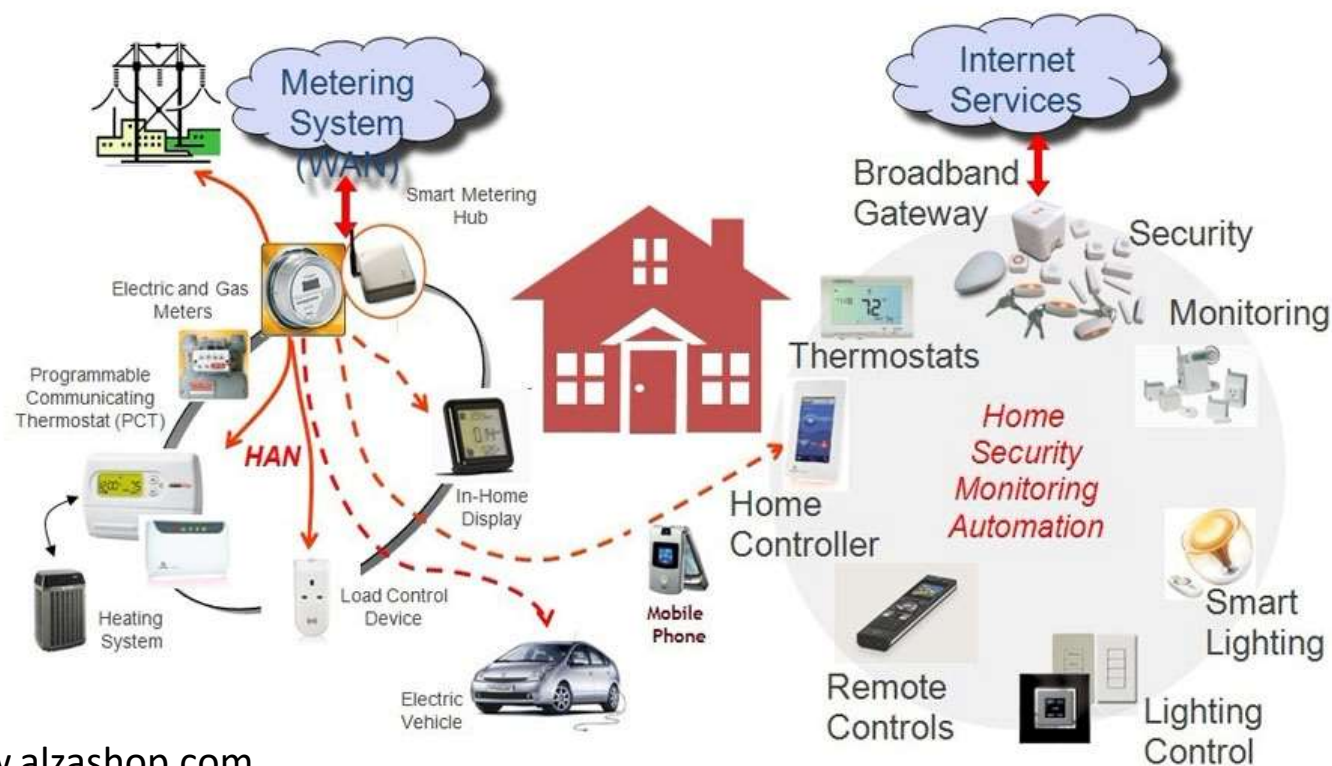
BLE HAN Communication Architectures

Star

BLE Sensor n

Pt2Pt

BLE Sensor k

Gateway/
Local server

Internet/
Cloud

Mesh

BLE Sensor n

Relay Node

BLE Sensor k

Gateway/
Local server

Internet/
Cloud

BLE Gateway

BLE Transceiver — uC — Ethernet/Wi-Fi

Power supply

Block diagram

Router
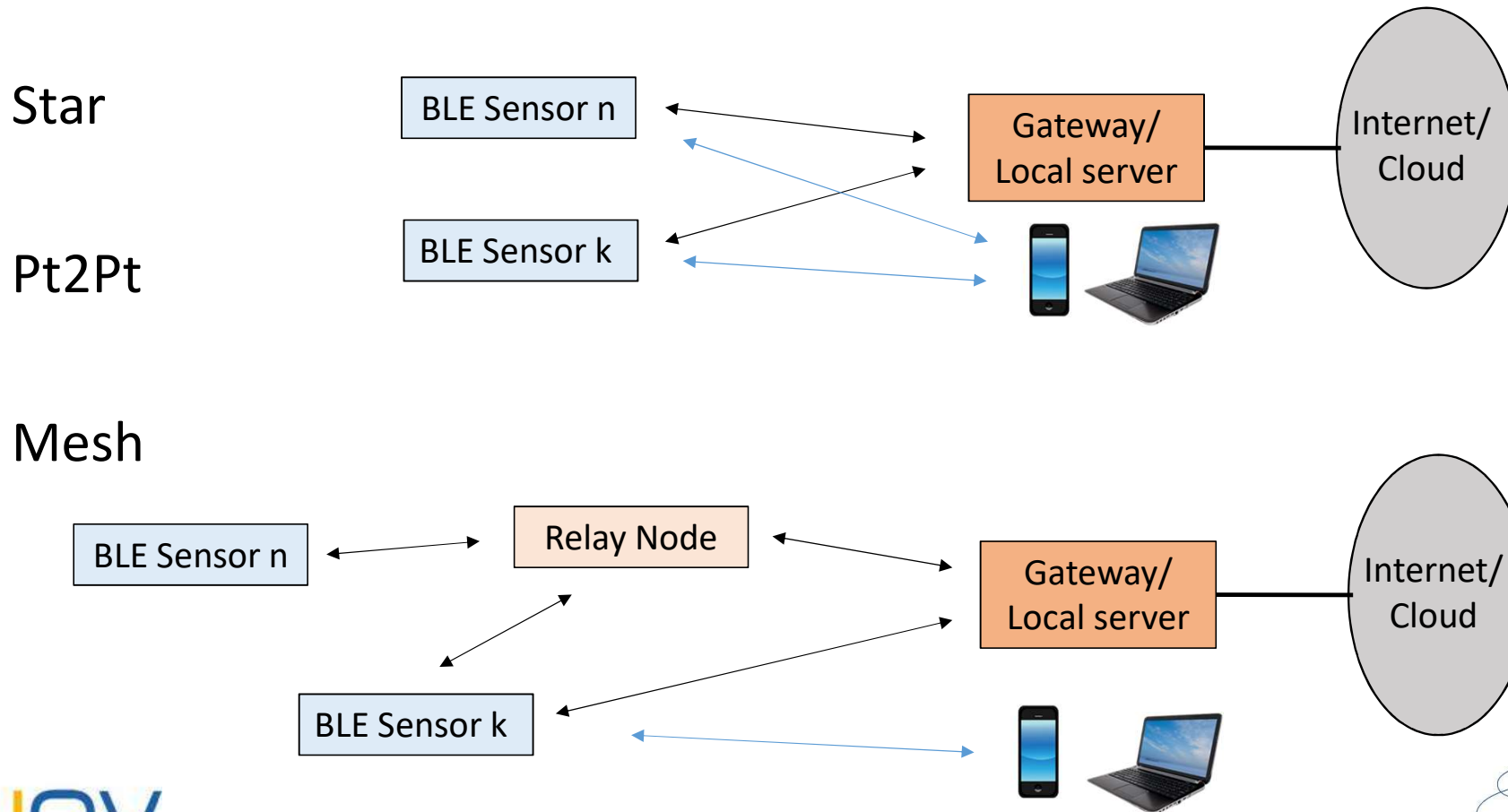
Gateway
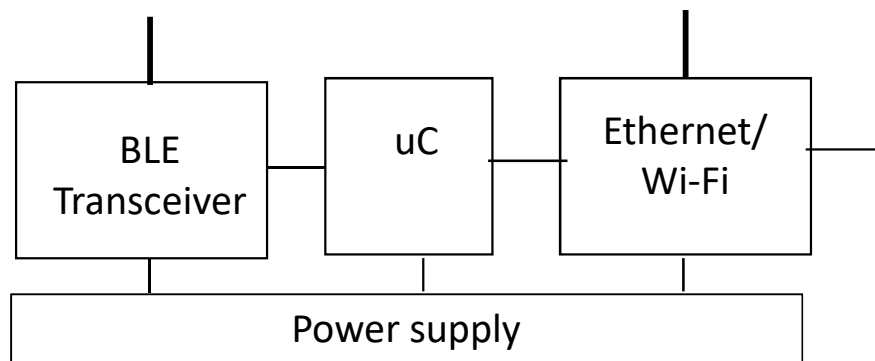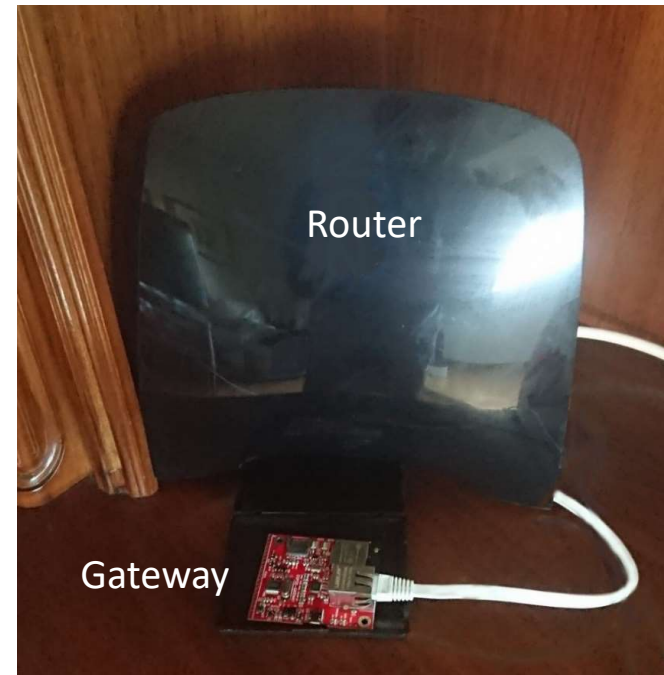
Cable/Fiber

Physical appearance

BLE Water Meter Sensor
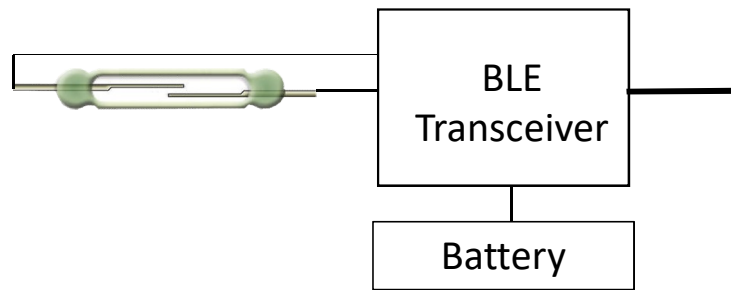
Block diagram

Physical appearance

The BLE water meter allows an easy integration with a water meter of read-relay probe type.

BLE Sensor Deployed in Domestic Water Meter

Common water meter

Probe hole

Smartphone (Android) Water Meter App

Water consumption (m3) →

BT GATT attributes

- Initialize water counter →
- Slot interval (15m/1h) →
- Time →
- Time adjust →
- Date →
- Water volume →
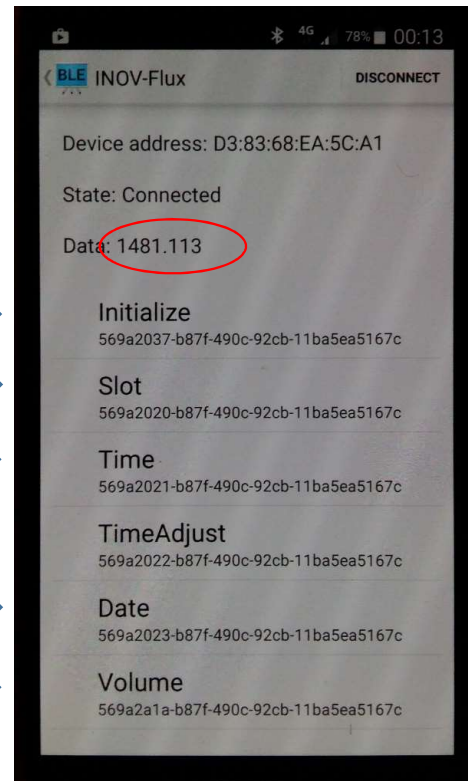
Windows Water Meter Application
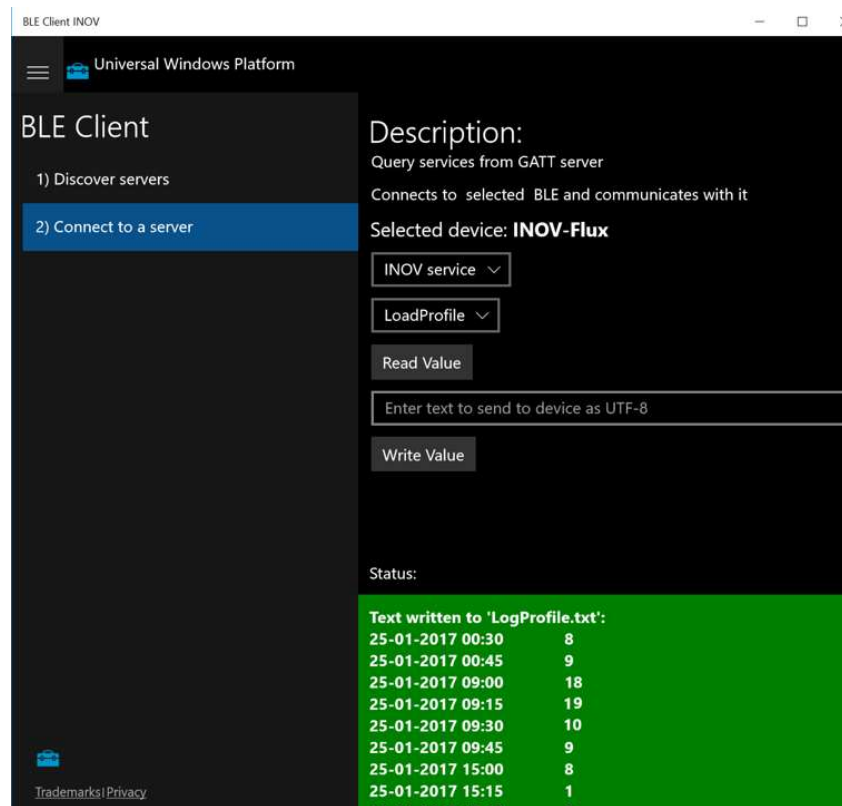
Windows Water App Functionalities

- Temperature
- Battery voltage
- Initialize water counter (w/ password)
- Slot counter interval, typical values 15m, 1h
- Set time
- Set date
- TimeAdjust, to calibrate real time clock
- Total consumption (dm3)
- Water flow (dm3/hour)
- Load profile (list of consumption slots)
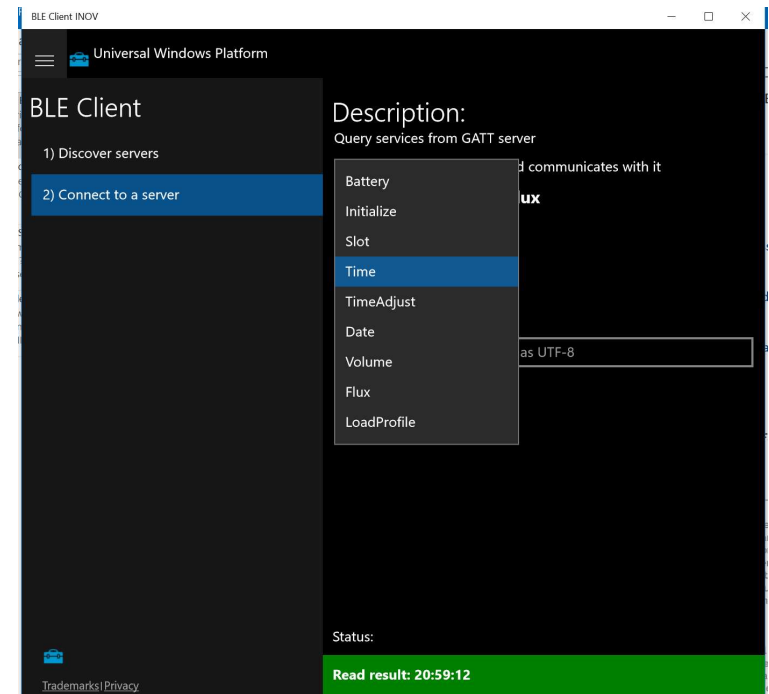
Example of Water Consumption Monitoring
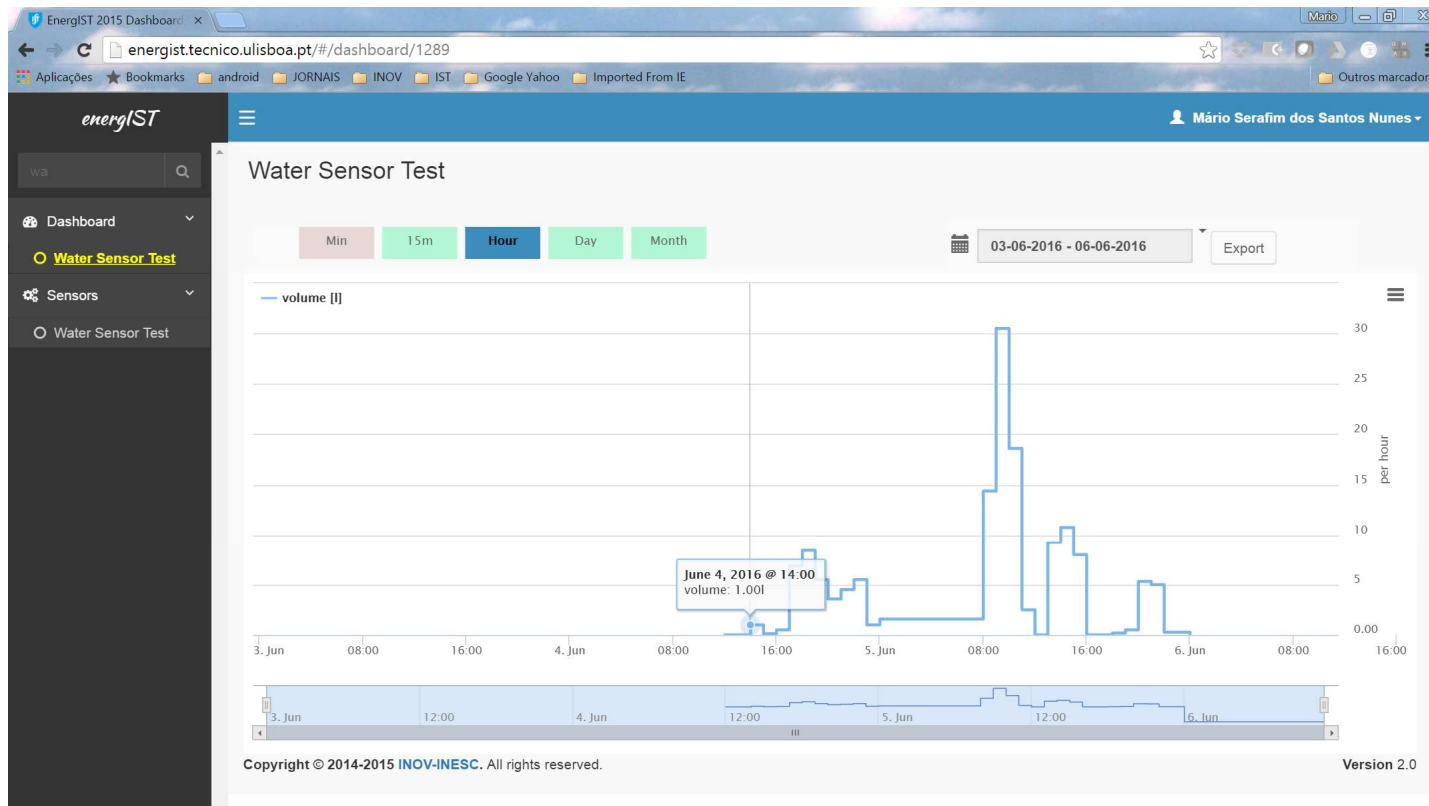
BLE Gas Meter Sensor
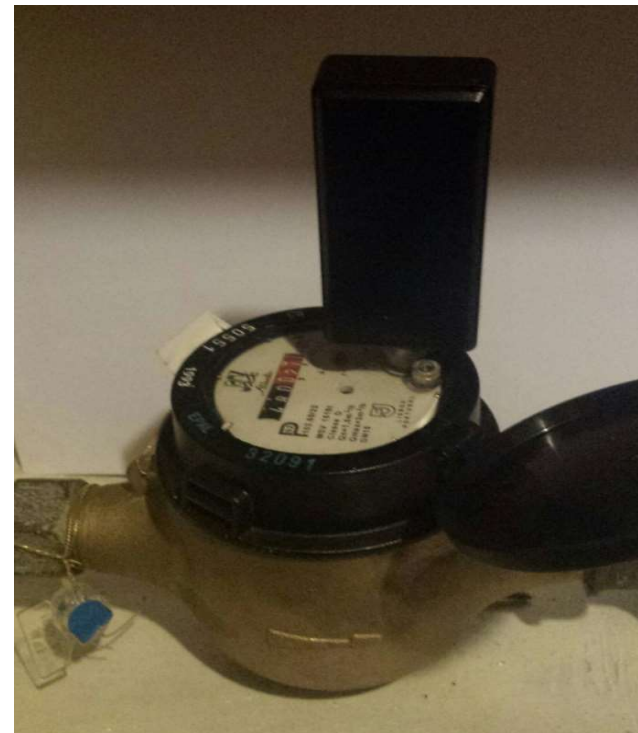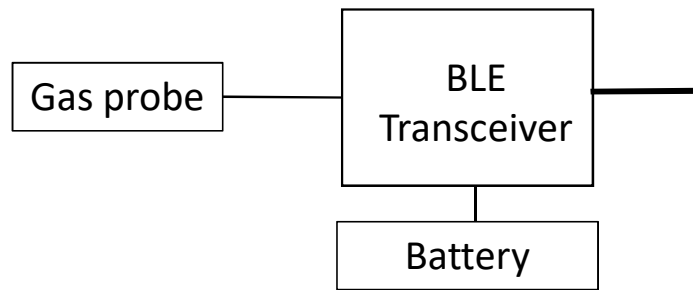

Block diagram

Physical appearance

BLE Electricity Meter Sensor

Block diagram

Physical appearance

Electricity App Functionalities

- Temperature
- Initialize energy counter
- Measurement interval (15m/1h)
- Time, Date
- Voltage (V)
- Current (A)
- Power (W)
- Power Factor
- Energy (kWh)
- Calibration (Voltage, Current, Power, Energy)

BLE Beacons

- Previous sensors requires pairing and a secure connection.

- Beacons broadcast information

- Beacon types:
  - Apple **iBeacons** (location)
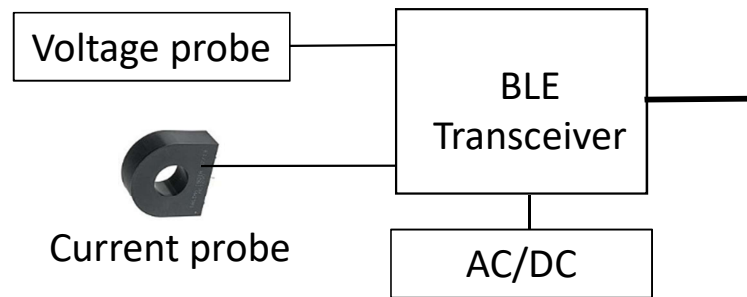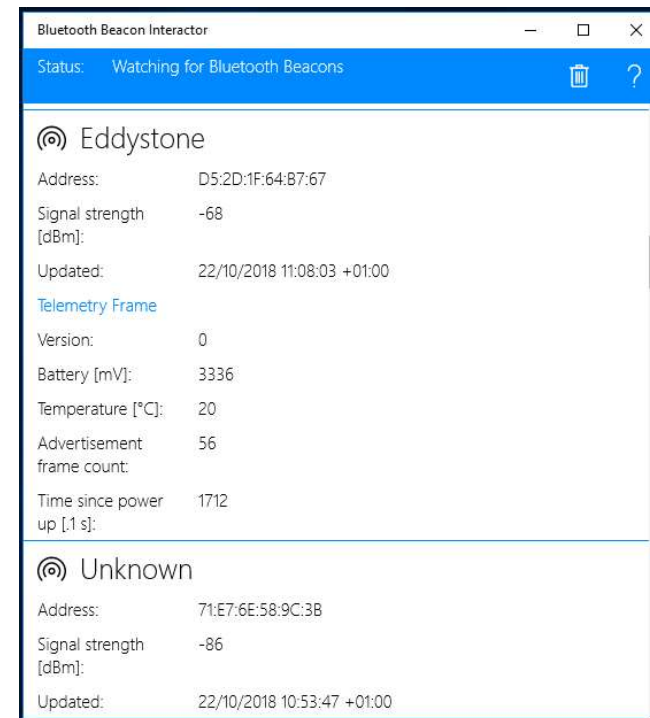 - Google **Eddystone** beacons
    - **Eddystone-UID** (location)
    - **Eddystone-URL** (URL)
    - **Eddystone-TLM** (battery, temperature, etc.)
      - Unencrypted/Encrypted

Bluetooth Beacon Interactor

Status: Watching for Bluetooth Beacons

Eddystone

Address:	D5:2D:1F:64:B7:67
Signal strength [dBm]:	-68
Updated:	22/10/2018 11:08:03 +01:00

Telemetry Frame

Version:	0
Battery [mV]:	3336
Temperature [°C]:	20
Advertisement frame count:	56
Time since power up [.1 s]:	1712

Unknown

Address:	71:E7:6E:58:9C:3B
Signal strength [dBm]:	-86
Updated:	22/10/2018 10:53:47 +01:00

Conclusions

- BLE based sensors are a good option for HAN, specially for battery operated devices, due to its very low power consumption and interoperability with smartphones.

- We plan to add BLE to LoRa sensors, for local access to information (saving costly displays)

- Future work will focus BT5 on BLE mesh applications.

Thank You

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