Intrinsically self-powered, battery-free and sensor-free ambient light control system

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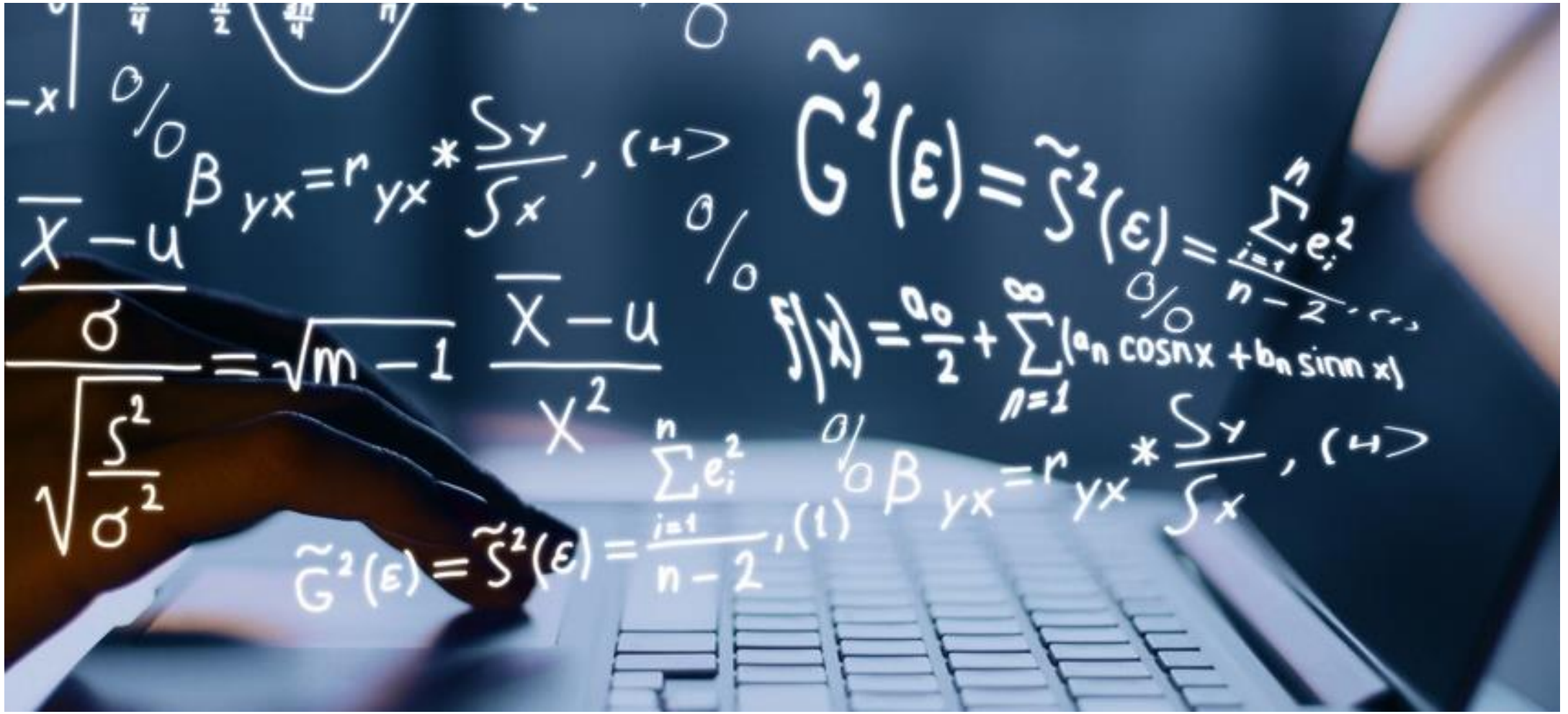
Agenda

1. The problem and the solution
2. How it works
3. Application areas
4. Take-aways

The problem and the solution



How to lower maintenance costs

Problem:

If only there was a way to reduce maintenance costs by using an energy efficient system that monitors ambient light conditions in real time and automatically adjusts the lighting control system.

Requirements:

- No wired connections
- Maintenance-free, low-cost solution
- Compact form factor

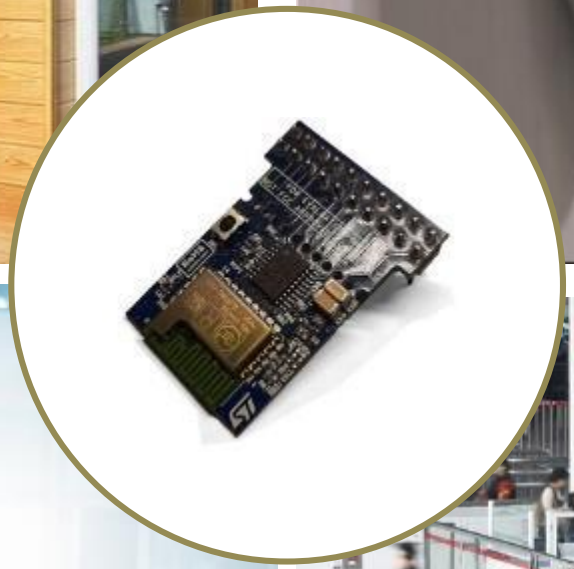
Solution:

Energy-harvesting wireless sensor node with ambient light sensing

Key features:

- Energy autonomous and battery-free device
- Wireless Bluetooth communication
- Possibility to add audio, environmental and motion sensing features for cost-efficient condition-based monitoring
- Easy to configure with OTA updates
- Set-and-Forget device

Automation for shutters



Automation for blinds

The right light, all the time

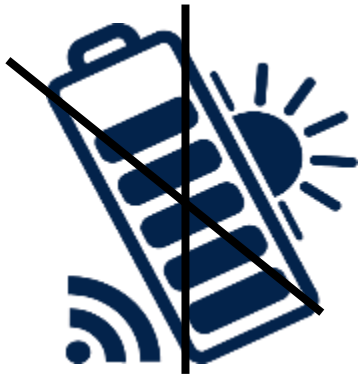
Battery-free wireless sensor node
STDES-BFTAG01

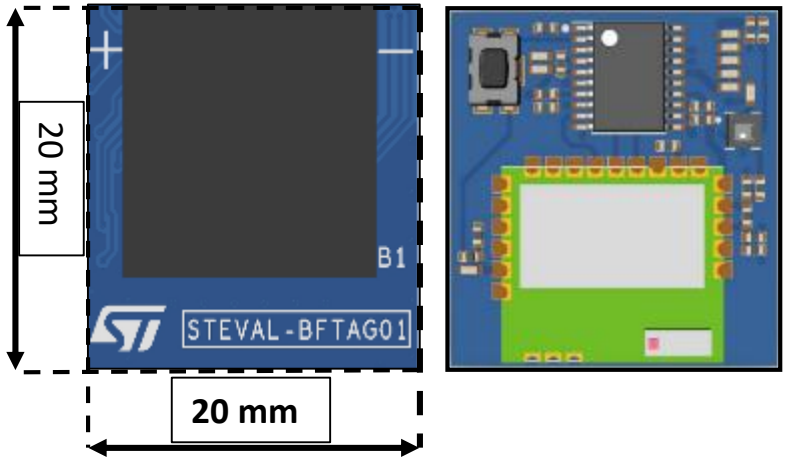
Highlights
- Energy autonomous and battery-free device
- Sensor-free light monitor
- Battery-free relative humidity and temperature monitor

Features
- Small form factor
- Bluetooth Low Energy (BLE) connectivity
- Low-cost solution
- Digital Read Out

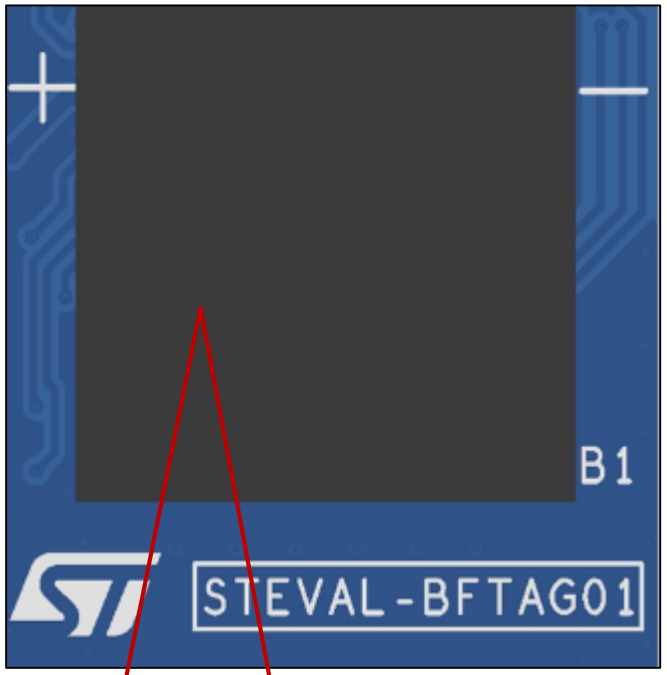
Applications
- Ambient light monitoring
- Predictive maintenance
- Asset tracking

How it works:
- It sends a number of beacons proportioned to the intensity of ambient light
- Self-powered by energy harvesting, e.g. a small solar panel

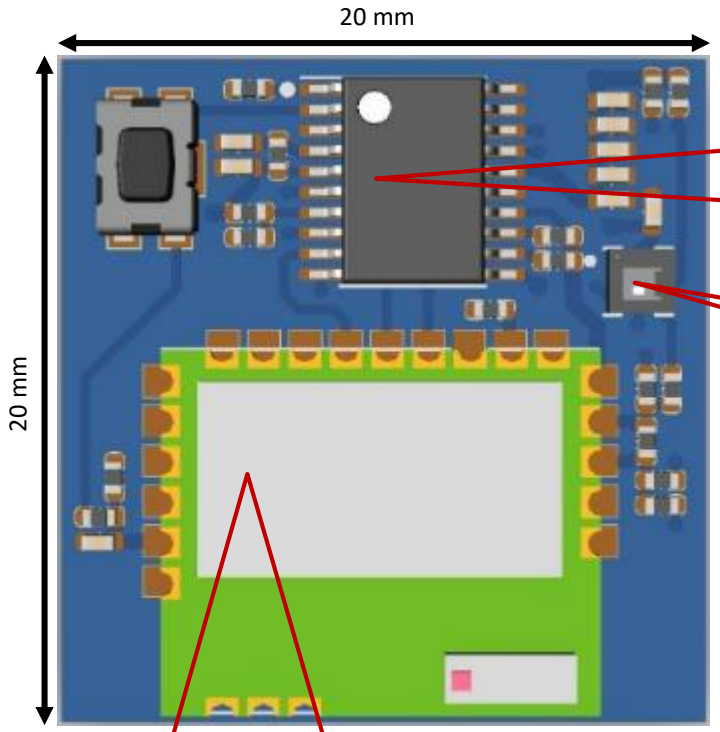




What is inside STDES-BFTAG01



Amorphous Silicon Solar Cell
AM 1606-C by Panasonic



BlueNRG-M2SP
Very-low-power application processor module for Bluetooth low energy v5.2

STM32L011F4
Ultra-low-power ARM Cortex-M0+ MCU with 16 Kbytes of Flash memory, 32-MHz CPU

HTS221
Ultra-compact sensor for relative humidity and temperature

How it works

How it works

Energy-harvesting wireless sensor node with ambient light sensing based on ultra-low-power STM32L0 MCU and BlueNRG-2 BLE 5.2 SoC

This wireless sensor node includes a single built-in photovoltaic transducer (a small solar panel) that performs the dual role of harvesting energy and sensing ambient light.

As soon as the PV transducer collects enough energy, it transmits a signal (beacon) via Bluetooth to a base (control) station. This means, the more light detected, the more beacons are sent, and vice-versa. By simply counting the number of beacons received, a base station (BS) is able to modify the lighting accordingly. An ultra-low-power STM32L0 microcontroller is used for the control and power management subsystem.

Advantages:

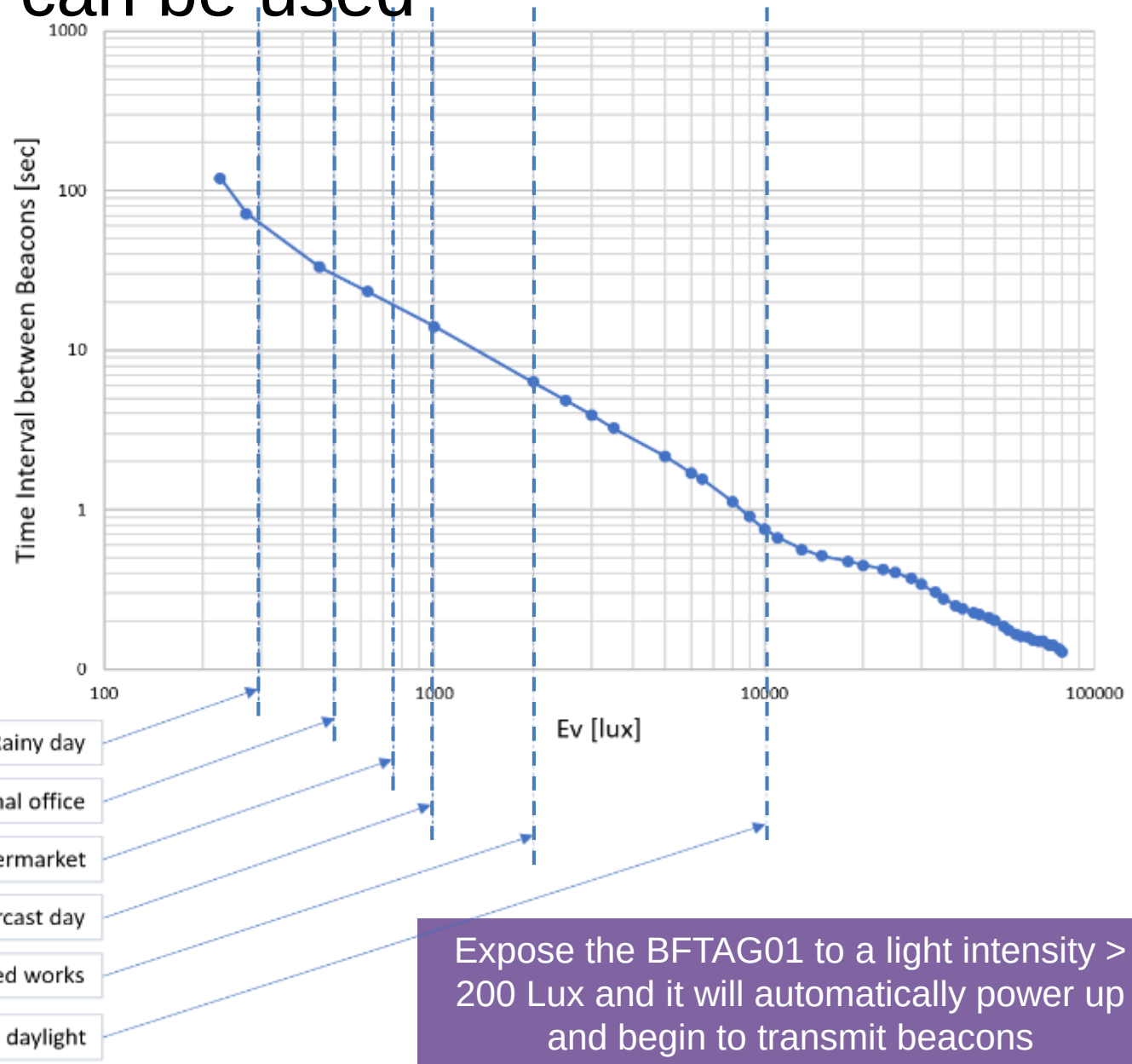
- Dual-use allows even smaller, cheaper nodes with a reduced BOM
- Self-powered by energy harvesting (no batteries nor wired connections required)

Where it can be used

Bluetooth Beacons

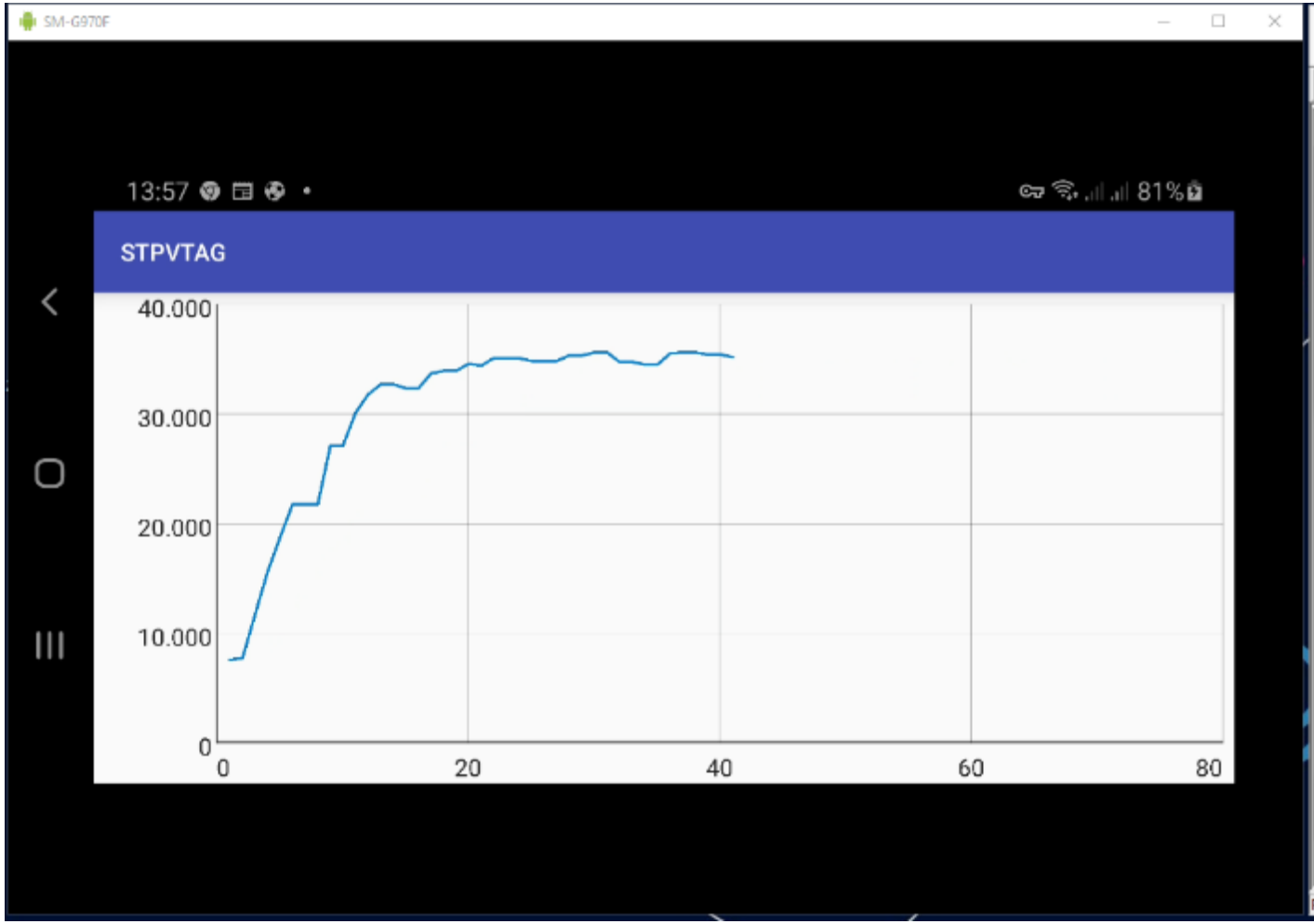
Base Station

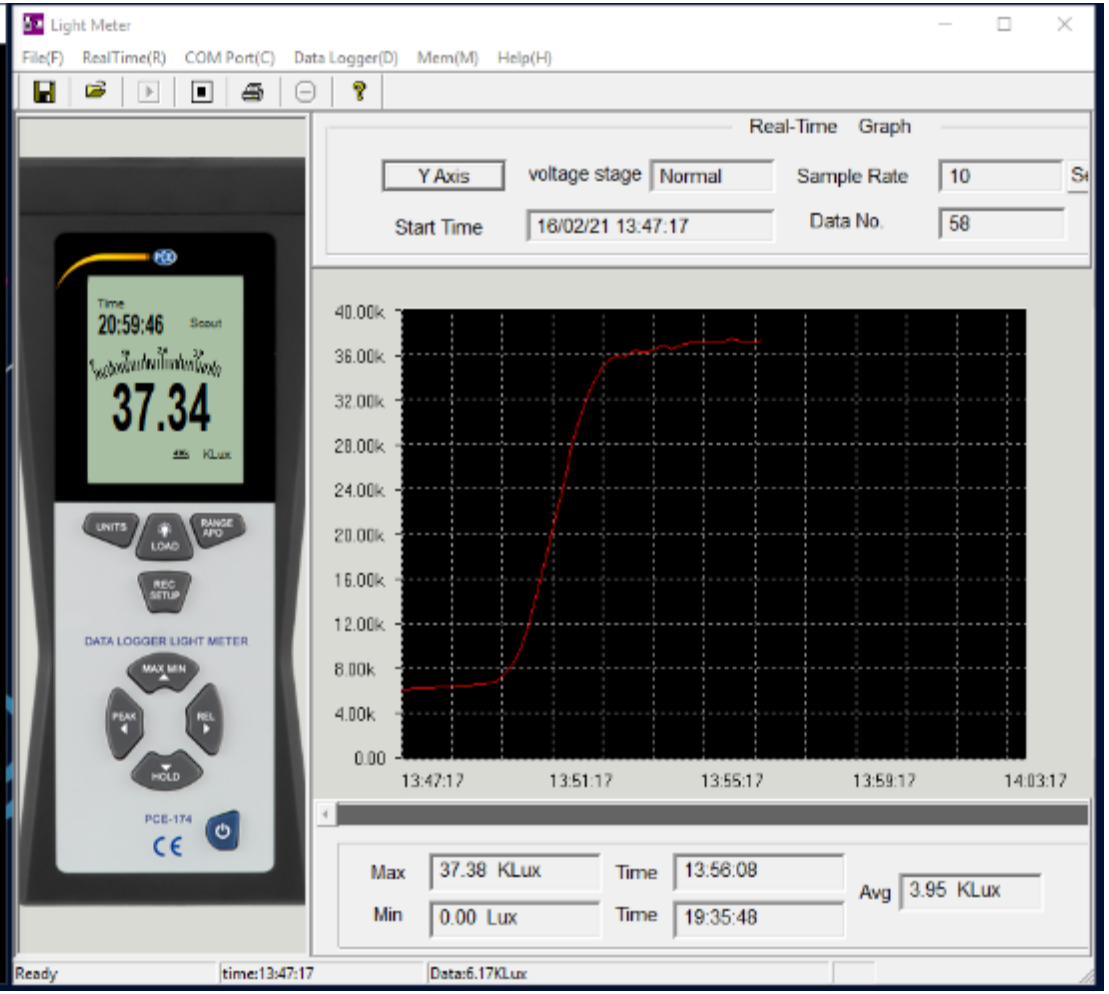
LoD = 200 lux



Expose the BFTAG01 to a light intensity > 200 Lux and it will automatically power up and begin to transmit beacons

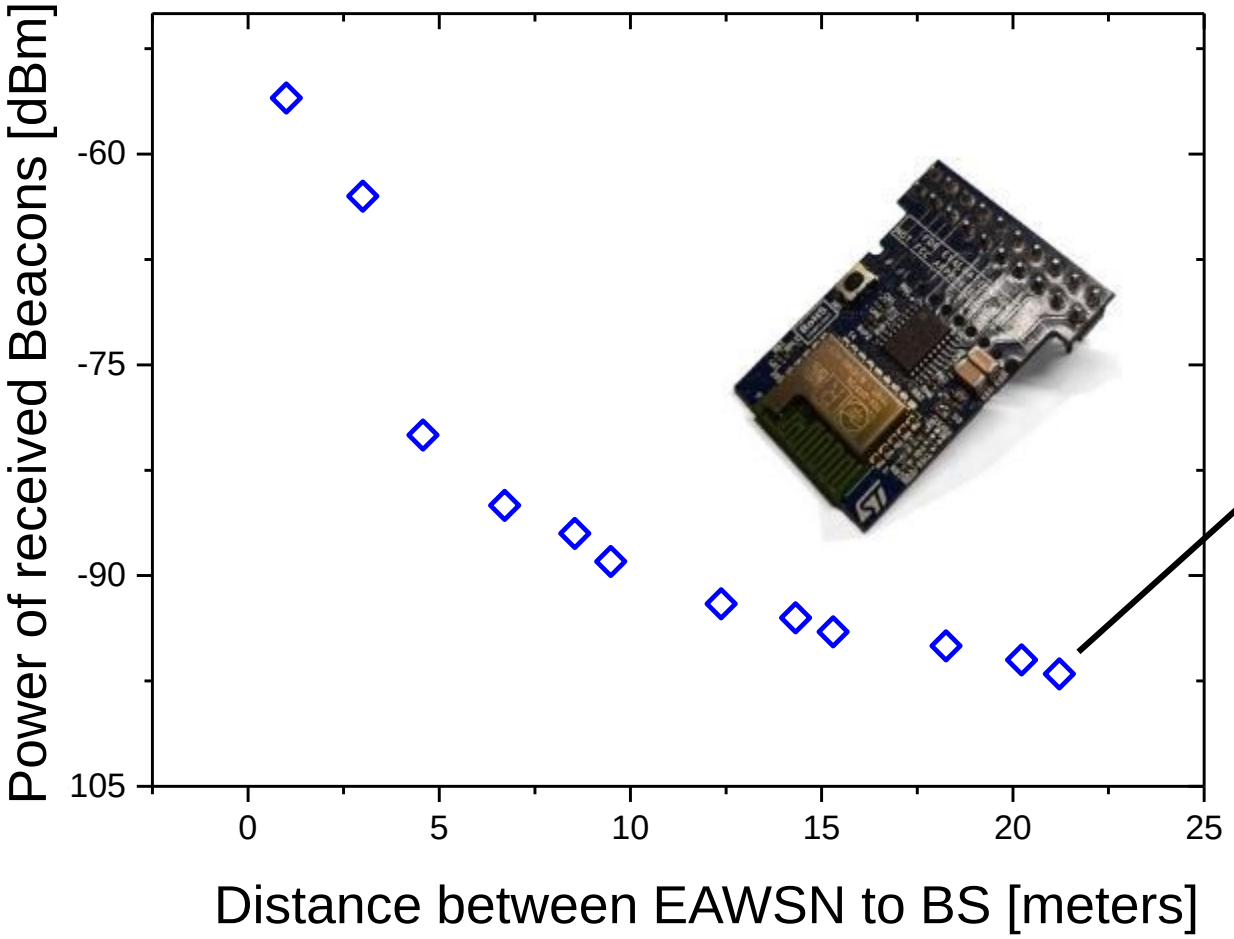
How it works


SM-G970F
13:57
81%
STPVTAG
40.000
30.000
20.000
10.000
0
0
20
40
60
80

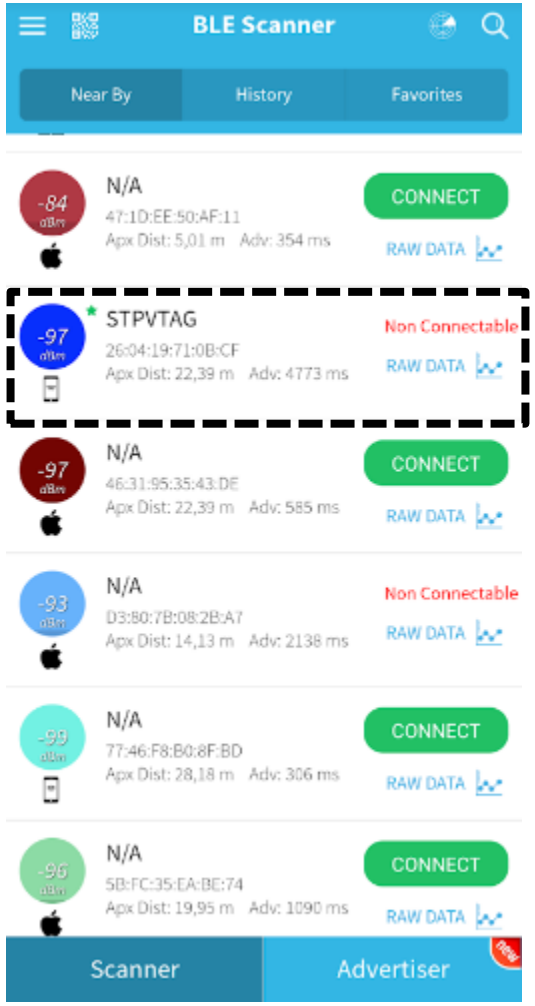

Light Meter
File(F) RealTime(R) COM Port(C) Data Logger(D) Mem(M) Help(H)
Real-Time Graph
Y Axis
voltage stage
Normal
Sample Rate
10
Start Time
16/02/21 13:47:17
Data No.
58
Time
20:59:46
Scout
37.34
KLux
DATA LOGGER LIGHT METER
PCE-174
40.00k
36.00k
32.00k
28.00k
24.00k
20.00k
16.00k
12.00k
8.00k
4.00k
0.00
13:47:17
13:51:17
13:55:17
13:59:17
14:03:17
Max
37.38 KLux
Time
13:56:08
Min
0.00 Lux
Time
19:35:48
Avg
3.95 KLux
Ready
time:13:47:17
Data:6.17KLux

Maximum transmission length: 20 meters

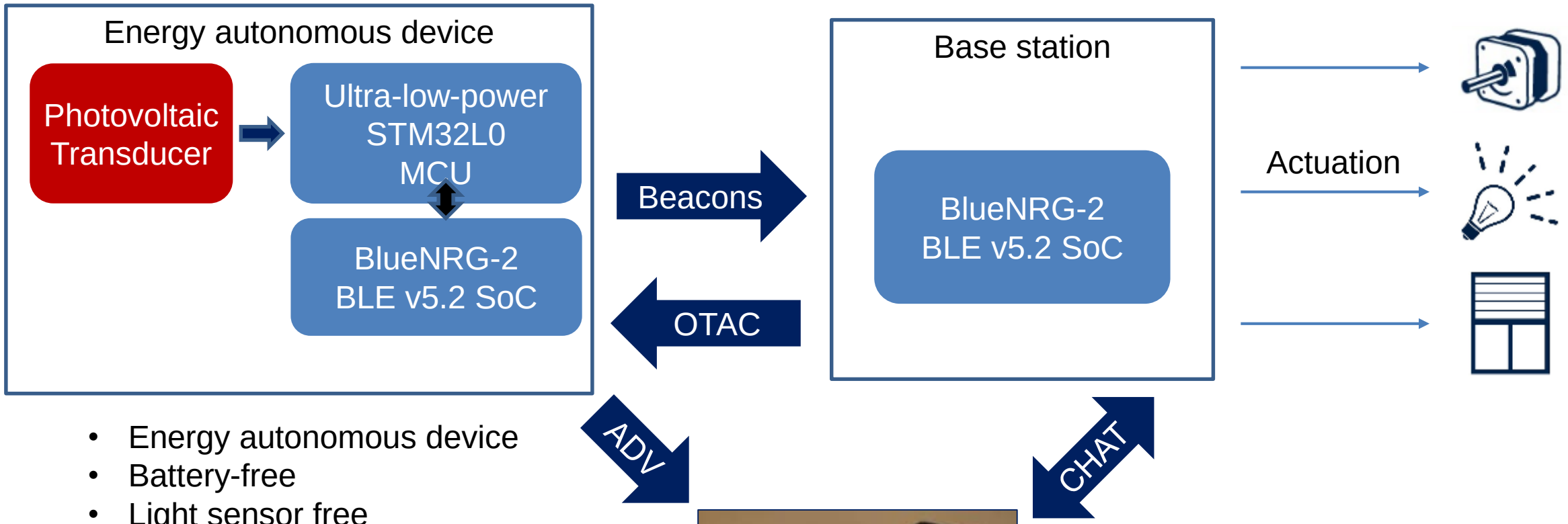
BLE Communication Range



BLE Scanner



Easy to configure and setup

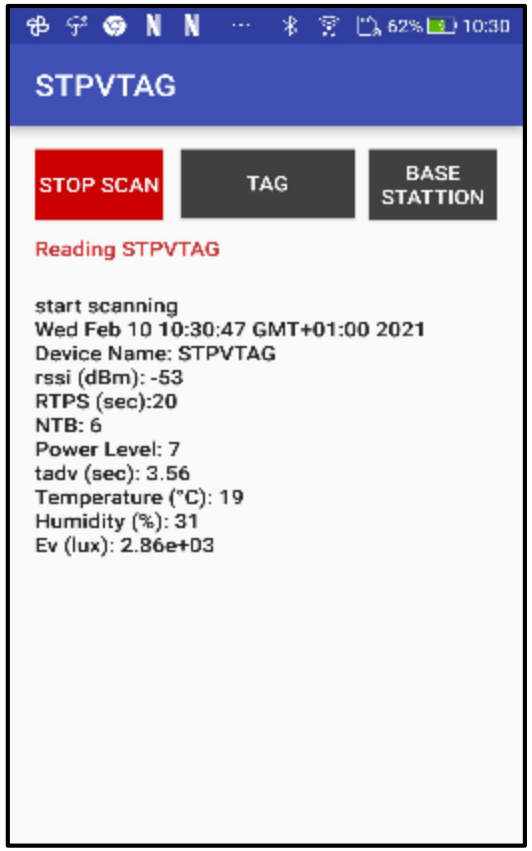


- Energy autonomous device
- Battery-free
- Light sensor free
- Flood network control
- Over the air configuration
- Small dimensions 2 cm x 2 cm
- Easy installation
- Auto configuration

- Time domain read out
- Data elaboration
- Communication quality awareness
- Over the air configuration
- Aging calibration

User resources

Easy-to-use STPVTAG mobile app



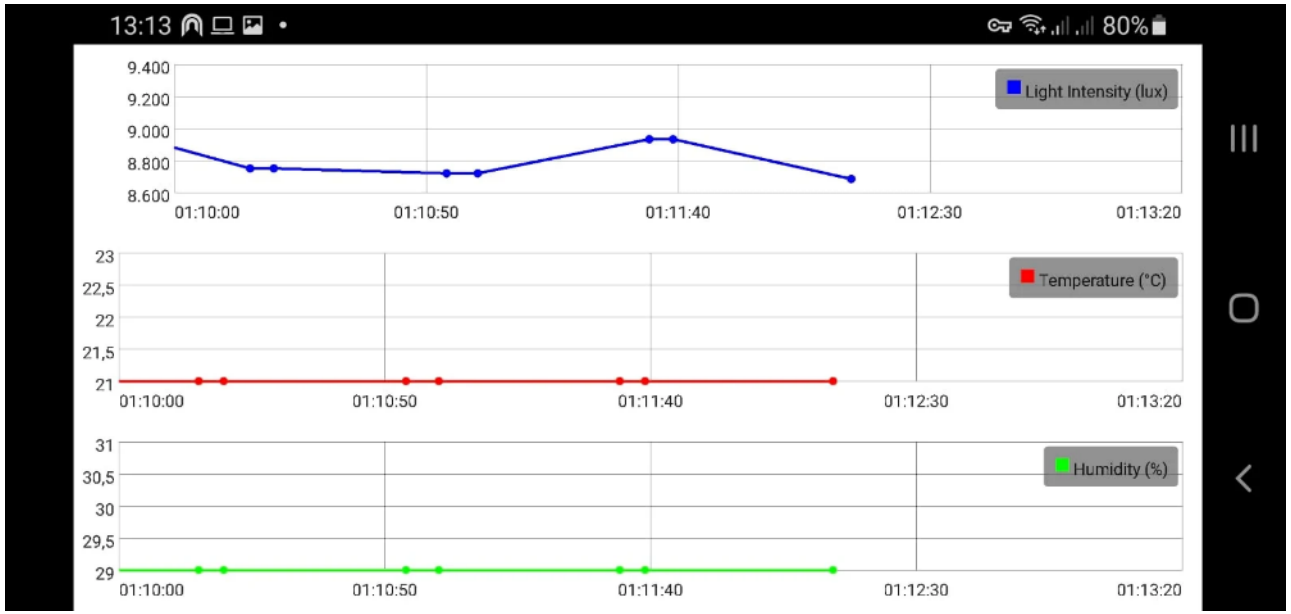
Key features

- Flood network control
- Over-the-air (OTA) configuration
- Easy installation
- Auto configuration
- Configurable via STPVTAG mobile app (Android)
- Temperature measurement
- Humidity measurement
- Light measurement

Easy-to-use STPVTAG mobile app

This mobile app performs three main functions:

1. Receive and display beacon data
2. OTA configuration of sensor node parameters
3. OTA configuration of base station parameters

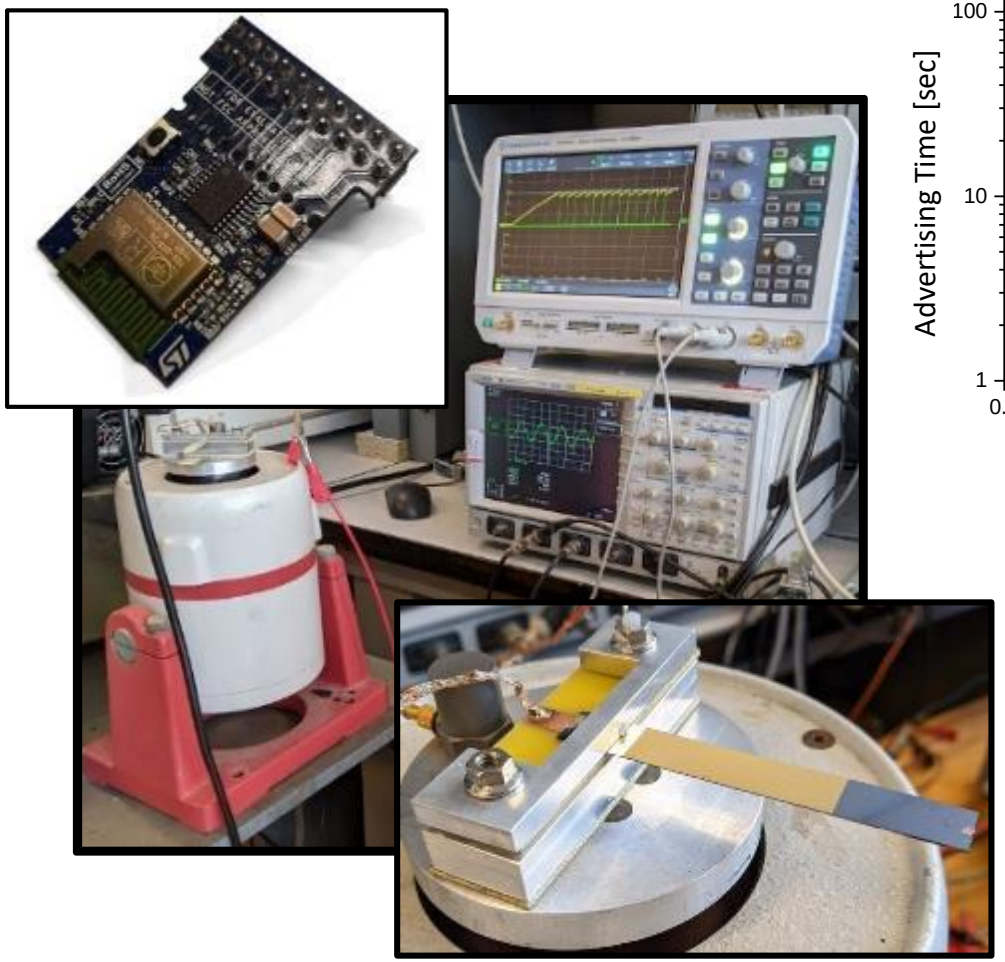


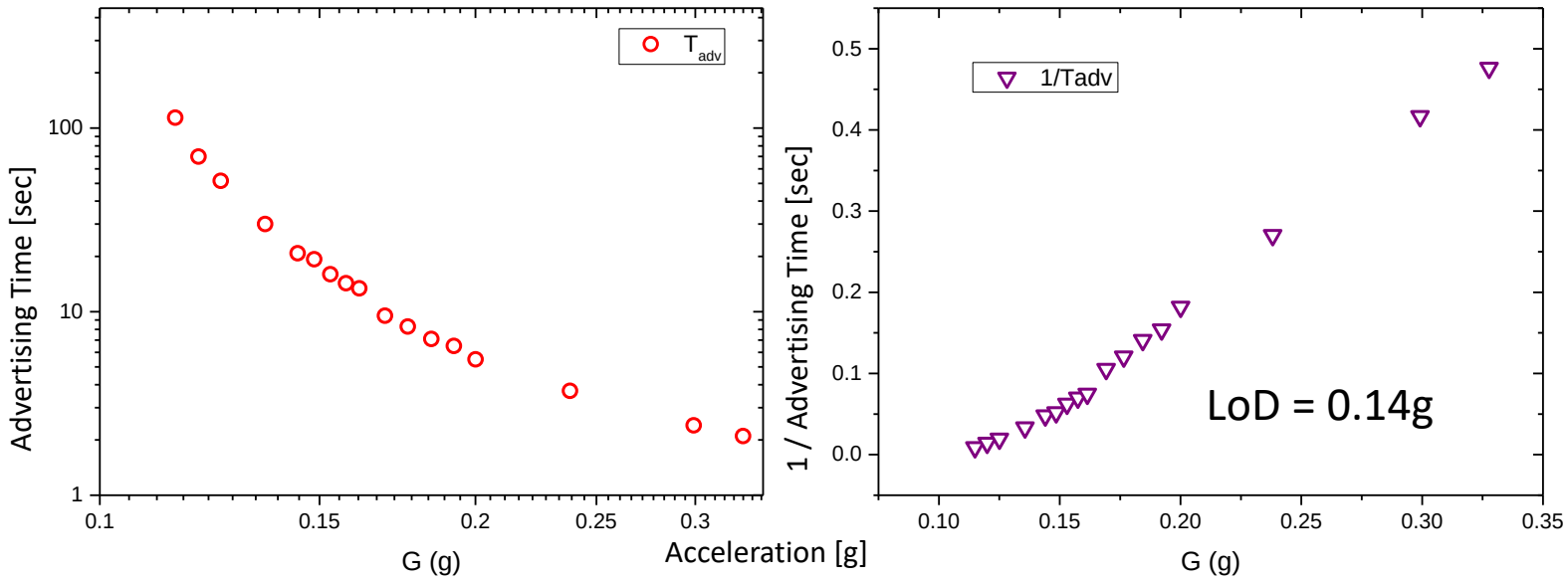
Available on Google Play for Android devices

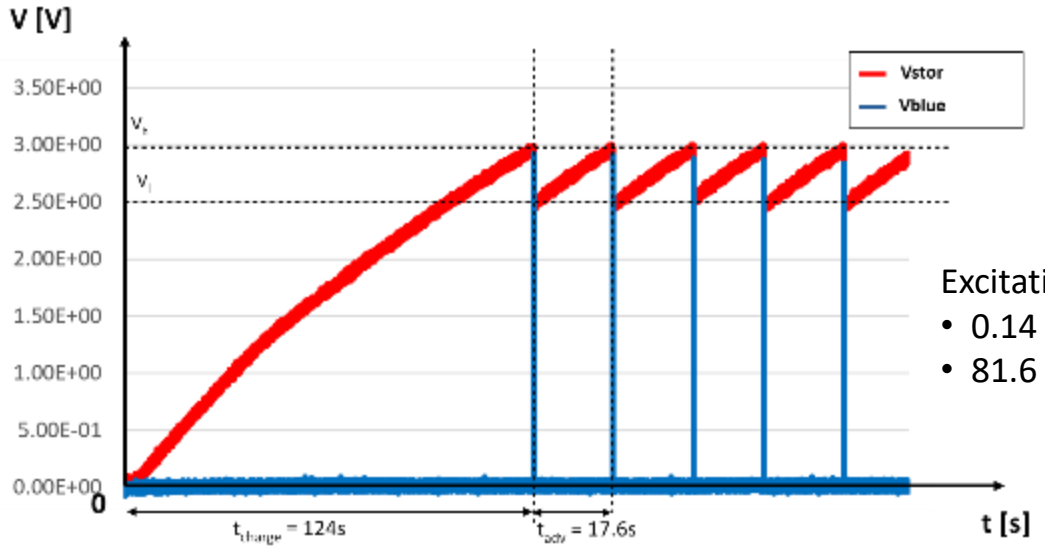
Application areas

Not only photovoltaic!

Energy autonomous battery-free and sensor-free vibration sensor





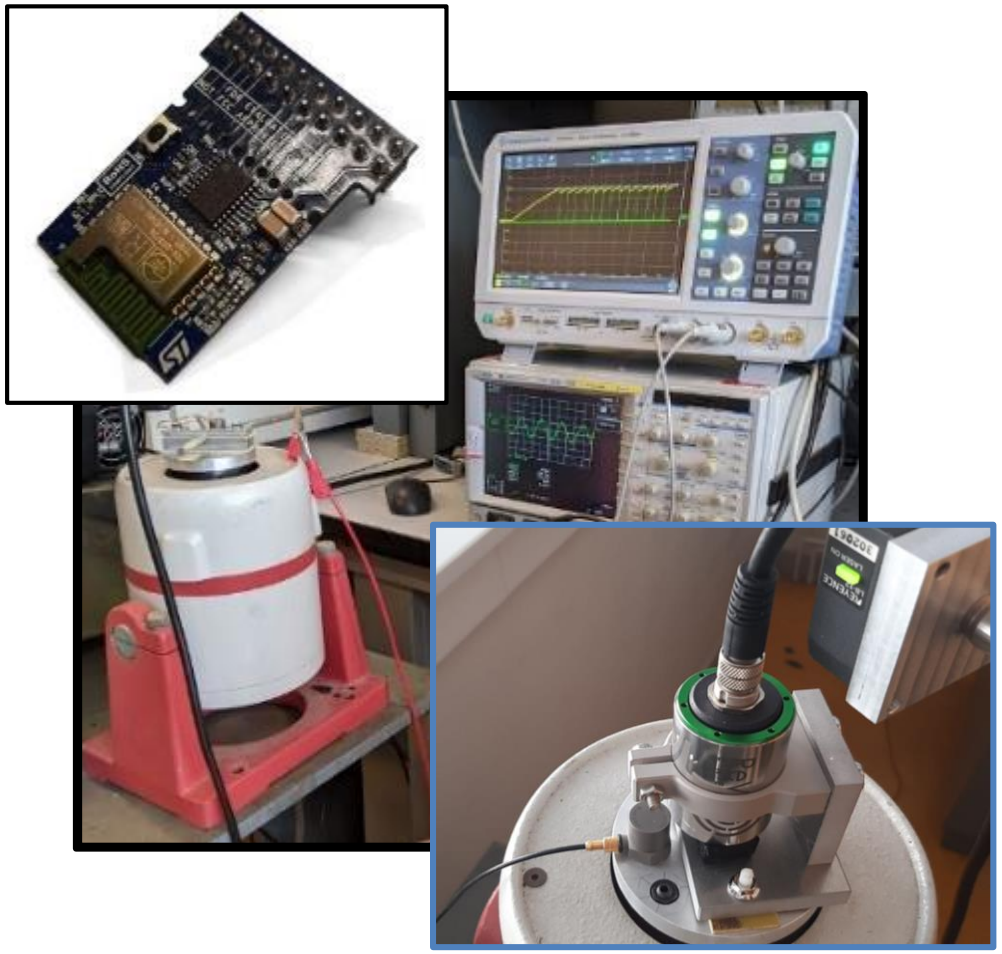


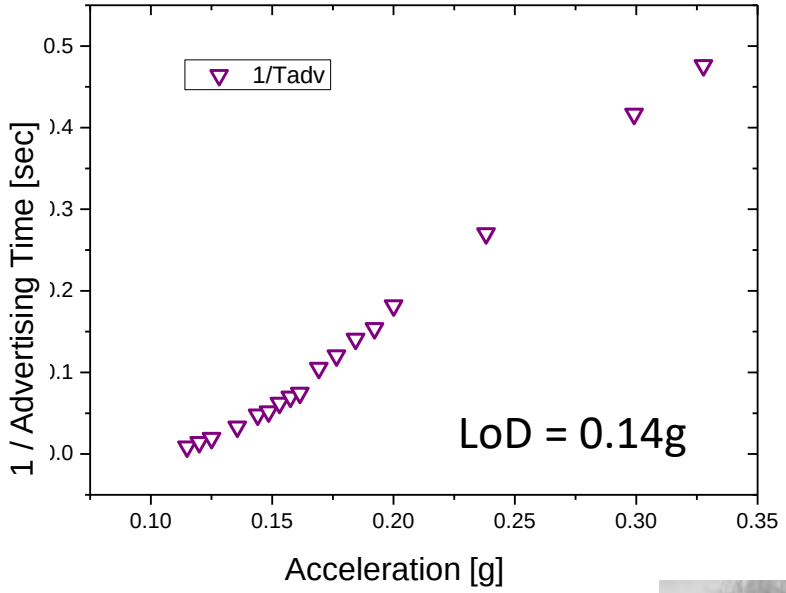
Excitation amplitude:

- 0.14 g
- 81.6 Hz

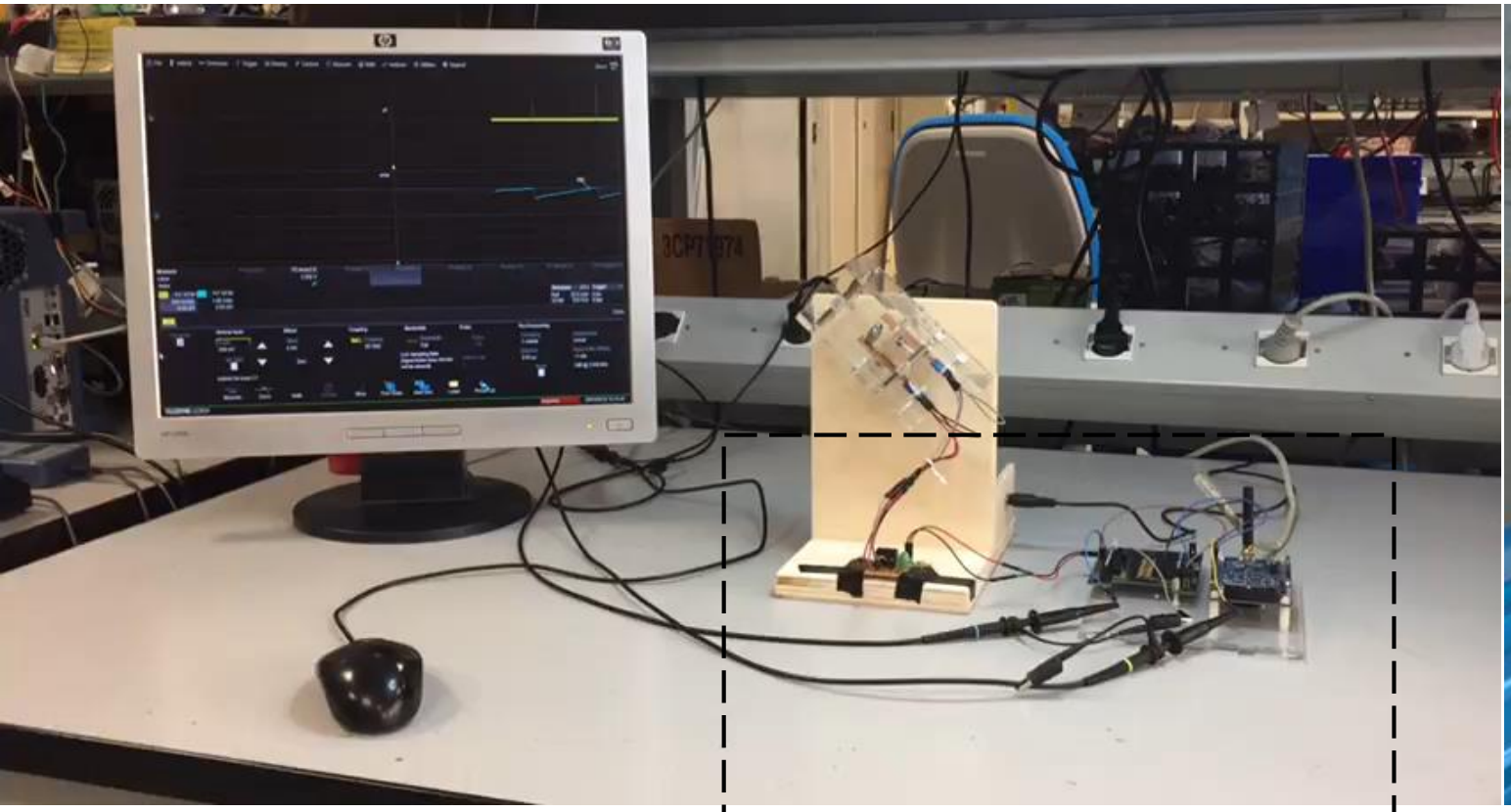
Transportation

Energy autonomous battery-free and sensor-free vibration sensor

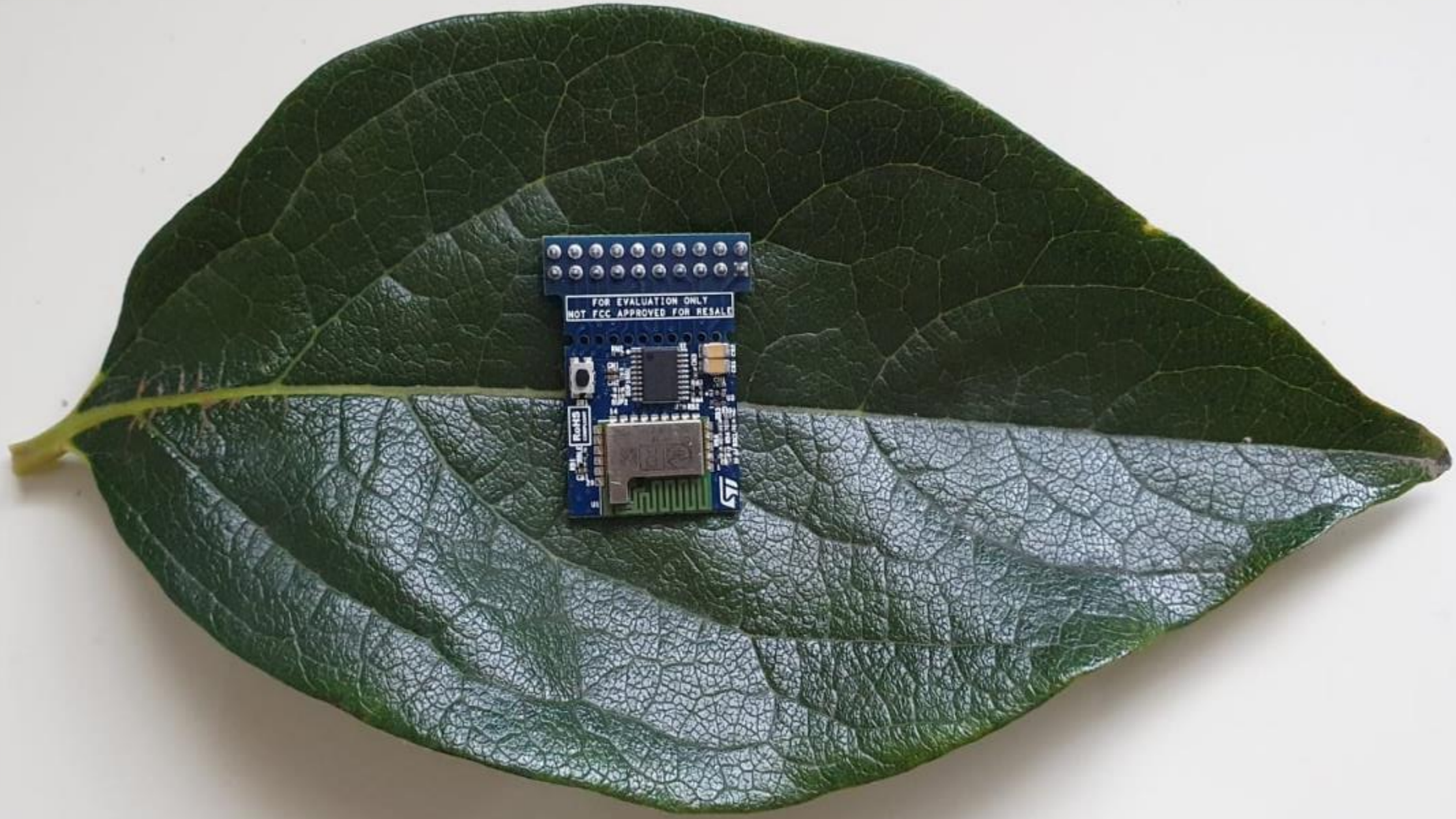




Industrial machines

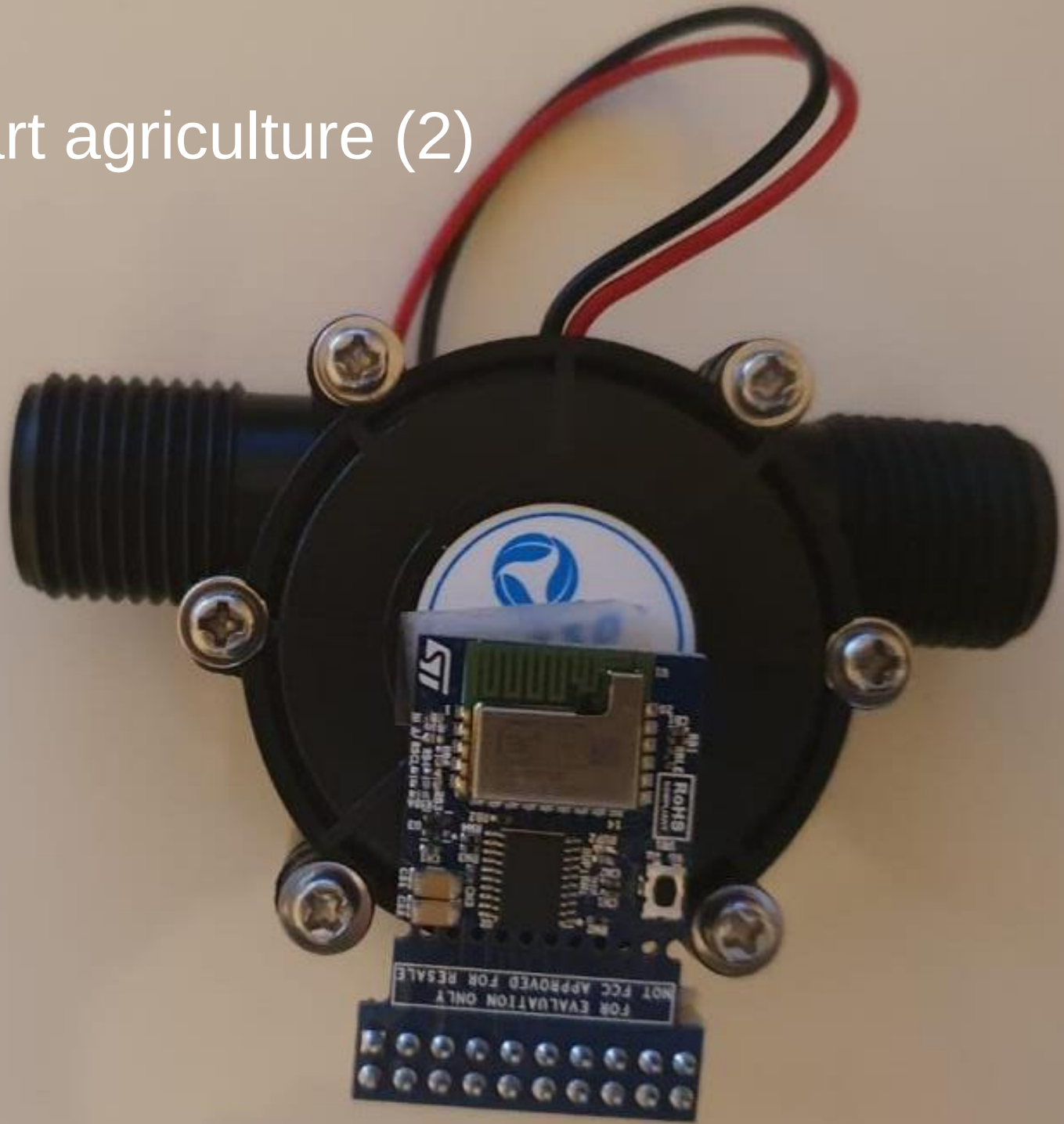


Smart agriculture



life.augmented

Smart agriculture (2)



STDES-BFTAG01
battery-free
hydraulic flow meter

Take-aways

Energy-harvesting wireless sensor node with ambient light sensing based on ultra-low-power STM32L0 MCU and BlueNRG-2 BLE 5.2 SoC

Advantages

- Energy autonomous device (battery-free)
- Light sensor not required (lower BOM)
- Wireless connectivity (no wires)
- Compact form factor (2 x 2 cm)
- Easy installation and auto configuration
- Off-the-shelf devices already available on the market
- Endless number of applications from industrial machines to smart homes and smart agriculture

Key functions

- Time domain read-out for real-time condition-based monitoring
- Relative humidity and temperature monitoring
- Data elaboration for improved analytics and diagnostics
- Quality awareness and aging calibration functions for reduced downtimes
- Easy-to-use over-the-air (OTA) configuration
- Anti-flooding mechanism to ensure widespread delivery and increased reliability

Thank you!