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EnerHarv 2024 Workshop Demo Session:

INTRO ELEVATOR PITCHES

Session Co-chairs:

Lorandt Foelkel, Würth Elektronik

Alessandro Piovano, POLITO



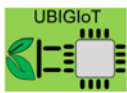
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Wednesday, June 26, 2024



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EnerHarv 2024 Workshop Demo Session:

enOcean Multi Sensor



Presented By –

Lorandt Fölkel, M.Eng
Würth Elektronik eiSos GmbH
Lorandt.folkel@we-online.de

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Demo Overview

 **Radio mini multi-sensor pure white glossy 44 x 44 x 16 mm. With integrated solar cell and battery CR1632 (not included). Smart home sensor.**

- This multi-sensor has temperature, humidity, lighting, acceleration and magnetic contact sensors integrated in one housing.
- It sends all data via EnOcean radio to the Eltako wireless building.
- The integrated solar cell generates the required energy from the ambient light indoors. This energy is stored internally so that the multi-sensor can also work for several days without light.
- The multi-sensor has an NFC interface, with which it can be configured using an NFC reader, a smartphone or a tablet.

 www.enocean.com

 www.eltako.de





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EnerHarv 2024 Workshop Demo Session:

enOcean Light switch



Presented By –

Lorandt Fölkel, M.Eng
Würth Elektronik eiSos GmbH
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Demo Overview

-  Light switch - flexible in use
-  A light switch is to be installed in a new location or an additional light switch is to be installed.
-  With the wireless light switch you have solved the problem very quickly.
-  No structural measures are necessary for laying the cables.
-  The radio light switch is placed anywhere and sends a signal to a radio receiver, in the desired lamp or to the radio multiple socket.
-  Thanks to IQ fy-EnOcean technology, this light switch is battery-free and therefore maintenance-free
-  www.enocean.com





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EnerHarv 2024 Workshop Demo Session:

enOcean prototype switch



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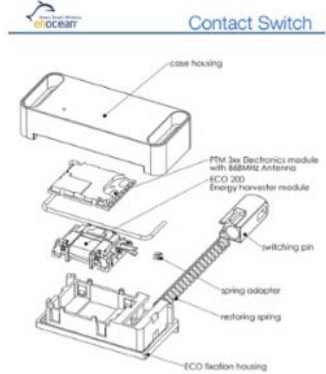
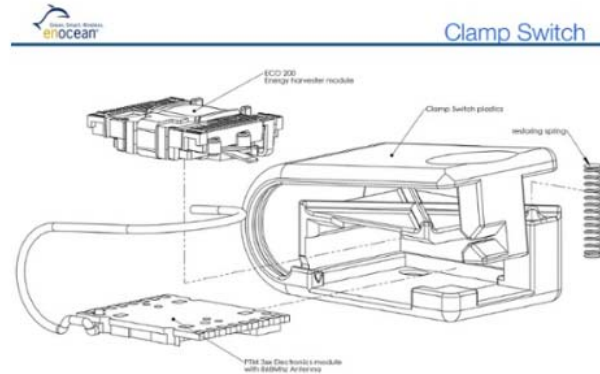
Demo Overview



Demo development kit for enOcean switch



The transmitter module PTM 535Z in 2.4 GHz (IEEE 802.15.4), combined with the energy converter ECO 200, has a smaller design than the PTM 215ZE. This makes it suitable for tailor-made switches for applications in the consumer sector, in industry or other fields of the IoT. 3D data available with the technical data sheet makes it easier to develop prototypes of different housings. Radio channel and security mode can be defined via the configuration interface.





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EnerHarv 2024 Workshop Demo Session:

Window handle with wireless transmitter



Presented By –

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Demo Overview

-  • Battery-free communication thanks to EnOcean technology 868MHZ
-  • Simple integration into your Smart Home/Smart Building system
-  • High transmission safety
-  • Low electromagnetic disturbance
-  • Two handle shapes to choose from: HOPPE “New York” and “Tokyo” lines
-  www.hoppe.com





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EnerHarv 2024 Workshop Demo Session:

Shower water temperature display



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Demo Overview



Shower water temperature display



no battery used



Using water flow as motion harvesting



**Can be found on Amazon / AliExpress /
Walmart / eBay**

Measures Water Temperature Accurately

Energy-saving and green, no need for battery. High-precision temperature sensor, there is only $\pm 1^\circ\text{F}$ error





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EnerHarv 2024 Workshop Demo Session:

TEG powered hot surface sensor



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Demo Overview

-  Functional at
-  - high temperature
-  - low temperature
-  - Humidity/submerged
-  - g-forces/vibrations
-  - darkness
-  - bright sunlight

Technical specifications			
Output voltage:	3.3 V	Recharge time at ΔT 40 °C:	150 s
Max peak current:	400 mA	Cold Start-up time at ΔT 20 °C:	1300 s
Power output at ΔT 40°C:	13 mW +/-10%	Recharge time at ΔT 20 °C:	650 s



Source: www.tegnology.dk



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EnerHarv 2024 Workshop Demo Session:

Energy Harvesting to Go kit



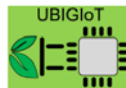
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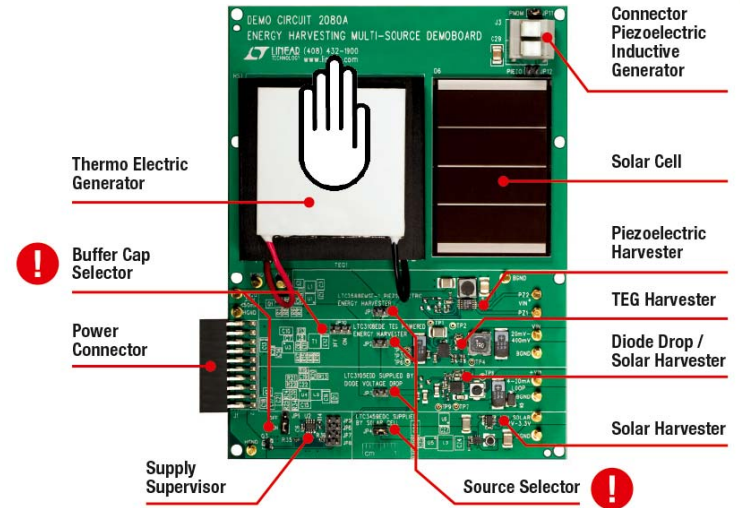
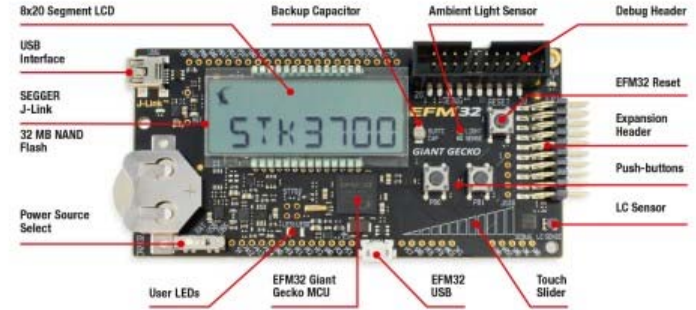
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Demo Overview

- 🔧 The “Energy Harvesting Solution To Go” provides the following benefits:
- 🔧 Complete solution for harvesting energy, energy management and storage
- 🔧 Easy transfer of this solution to your design
- 🔧 Evaluation of the highest efficient components in the market
- 🔧 Collaboration with Analog Device and Silicon Laboratories
- 🔧 Harvesting source:

- Solar
- TEG
- Piezo or Inductive
- Diode voltage drop





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EnerHarv 2024 Workshop:

EnTICe- Energy Harvesting Testbed with Remote Cloud Access



Presented By –

Eoin Ahern,

Senior Research Engineer

Tyndall National Institute

[eoin.Ahern@tyndall.ie]

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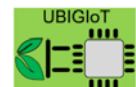
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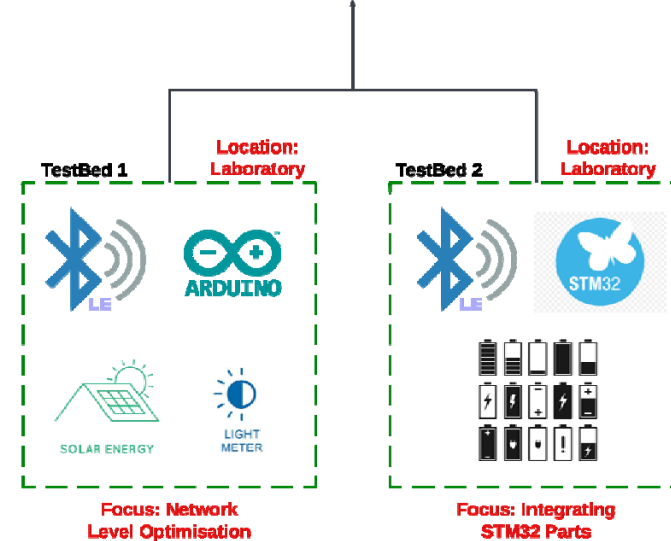
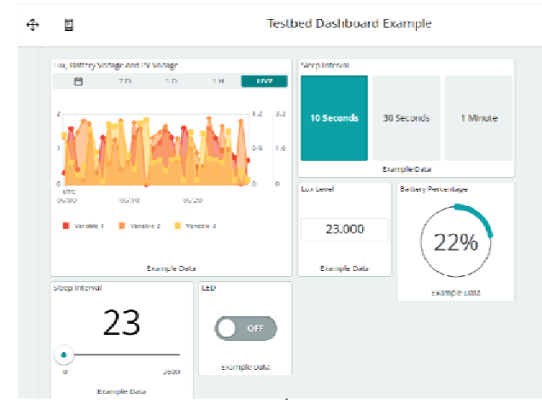
Energy Harvesting
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EH Testbed Demo Overview

-  **Energy-Harvesting Powered Wireless Sensors (EH Powered Arduino, Battery Powered STM32) to Cloud Application**
-  **Incorporating Sensor technology, Wireless Communication, Power Storage and Management**
-  **Aim to Provide Applications for Energy Harvesting Tech Developers, and Energy Harvesting Tech for Application Developers**





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EnerHarv 2024 Workshop Demo Session: *Optimization of Energy Harvesting-Wireless Sensor Nodes via a Simulation Tool*

Presented By –

Mario Costanza, Dr.
Tyndall National Institute
mario.costanza@tyndall.ie



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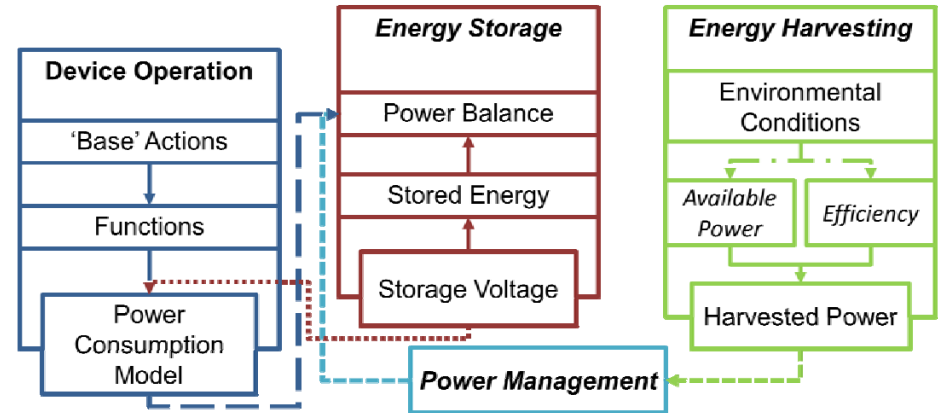
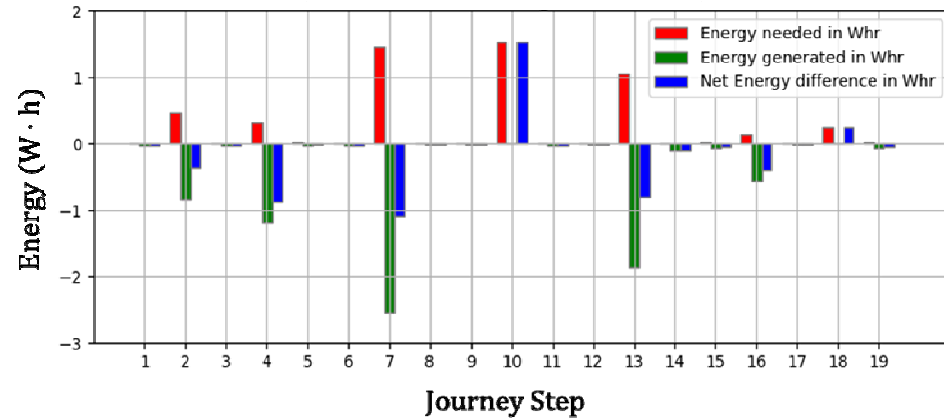
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Demo Overview

 Optimization of Wireless Sensor Nodes via context-aware modelling

 First proof-of-concept model applied to solar-powered nodes on dry containers

 Next version allows for greater flexibility and granularity





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EnerHarv 2024 Workshop Demo Session:

On-chip power management interface for sliding triboelectric nanogenerator

Presenter: Ir. Wenyu Peng

Advisor: Prof. Sijun Du

Delft University of Technology

W.Peng@tudelft.nl



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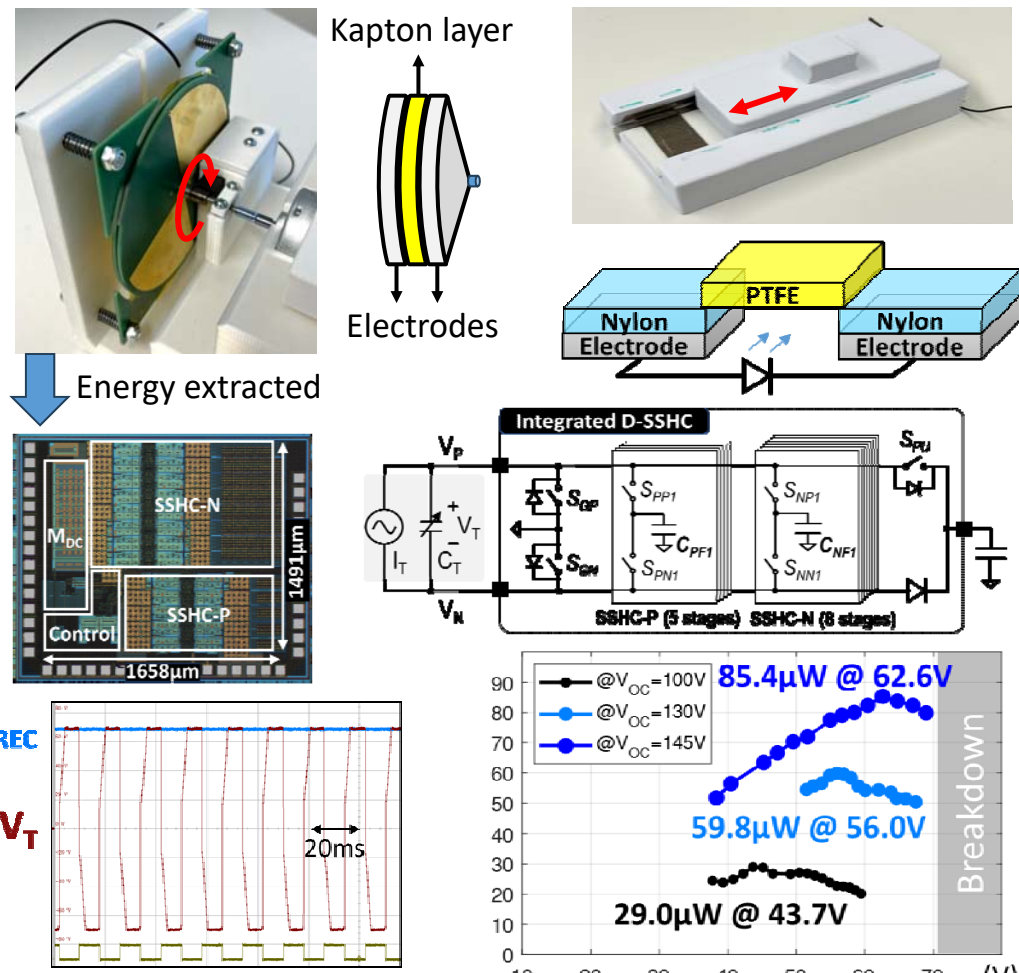


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Demo Overview

Two triboelectric nanogenerator (TENG) prototypes are fabricated to harvest mechanical energy from rotational and laterally-sliding movement respectively and presented to light the LED.

The proposed on-chip triboelectric energy harvesting and managing interface extracts energy efficiently.





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EnerHarv 2024 Workshop Demo Session: *Ammonia Monitoring: LoRa and BLE sensors, ultra-low power and energy independent.*

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Presented By

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roberto.larosa@innoitay.com

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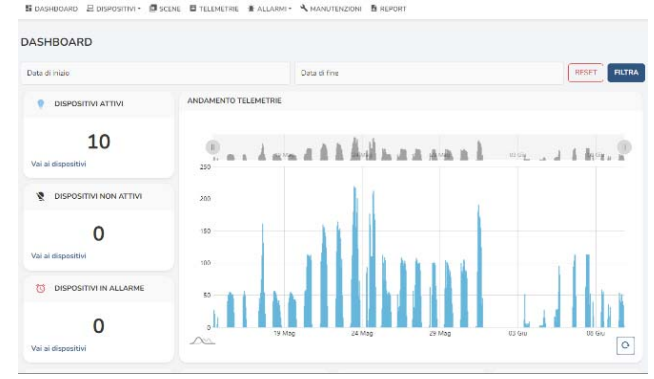
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Demo Overview: Energy Autonomous Wireless Sensor Node for Ammonia Monitoring with LoRa Connectivity



Dashboard





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EnerHarv 2024 Workshop Demo Session: *Oxygen Monitoring: LoRa and BLE sensors, ultra-low power and energy independent.*

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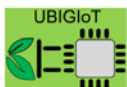
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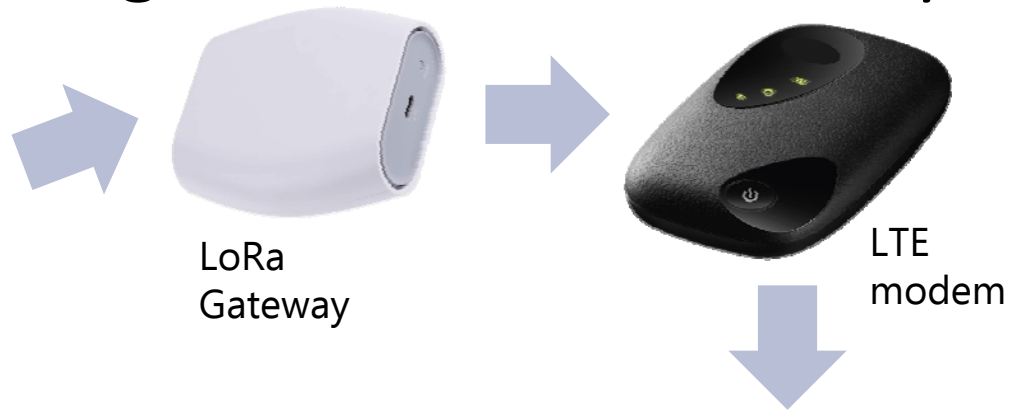
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Demo Overview: Energy Autonomous Wireless Sensor Node for Oxygen Monitoring with LoRa Connectivity



Dashboard





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EnerHarv 2024 Workshop Demo Session: *Smart energy solution for standalone beacons*



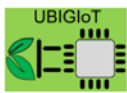
**Presented By –
Yongli Wang Dr.**

Corporate Research and Development
Piezo&Protection Devices Business Group






TDK Electronics GmbH & Co OG
Siemensstrasse 43, 8530 Deutschlandsberg, Austria
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Demos overview

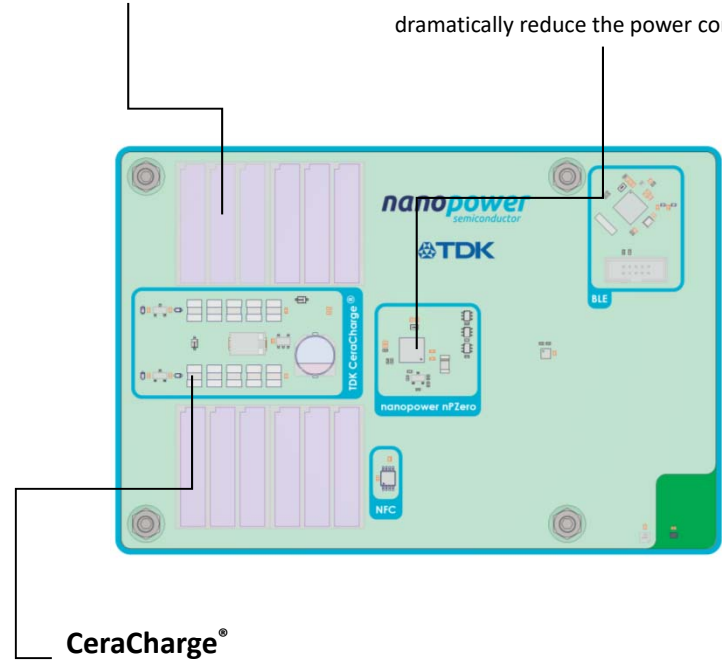
-  **Energy harvesting with high efficiency thin film solar cells**
-  **Energy storage with all-solid-state batteries**
-  **Energy saving with nPZero IC**
-  **Sensing temperature, movement, and illumination**
-  **Beaconing with BLE**

Film solar cell

- Amorphous silicon film solar cell

nPZero power-saving IC

- A new architecture and new method to dramatically reduce the power consumption



CeraCharge®

- Rechargeable all-solid-state SMT compatible battery



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EnerHarv 2024 Workshop Demo Session: *Bluetooth v5.4 Large ESL Powered with Energy Harvesting*



Presented By – Bruno DAMIEN
Ecosystem and Partners Director

bruno.damien@e-peas.com



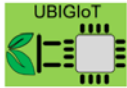
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Demo Overview

 **Big 3-color VGA display ESL**

 **Powered by e-peas PMIC**

■ **AEM00920**

■ small DSSC PV

■ Small 15mAh NiMH

AEM00920



 **Replacing 4 x CR2450**

 **Bluetooth v5.4 connectivity**

 **Picture swap**





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EnerHarv 2024 Workshop Demo Session:

Perovskite-PV-powered Small ESL



Presented By – Bruno DAMIEN
Ecosystem and Partners Director

bruno.damien@e-peas.com



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Demo Overview

 **Small 3-color VGA display ESL**

 **Powered by e-peas PMIC**

- **AEM10330**

- 4-cells small Perovskite PV

- Small 70mAh LiPO

 **Replacing 4 x CR2450**

 **Sub1GHz connectivity**

AEM10330





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EnerHarv 2024 Workshop Demo Session: *OPV, a Photodiode and Energy Source to Power the STM32U0 Microcontroller*



Presented By

Dr Hani KANAAN

Business development

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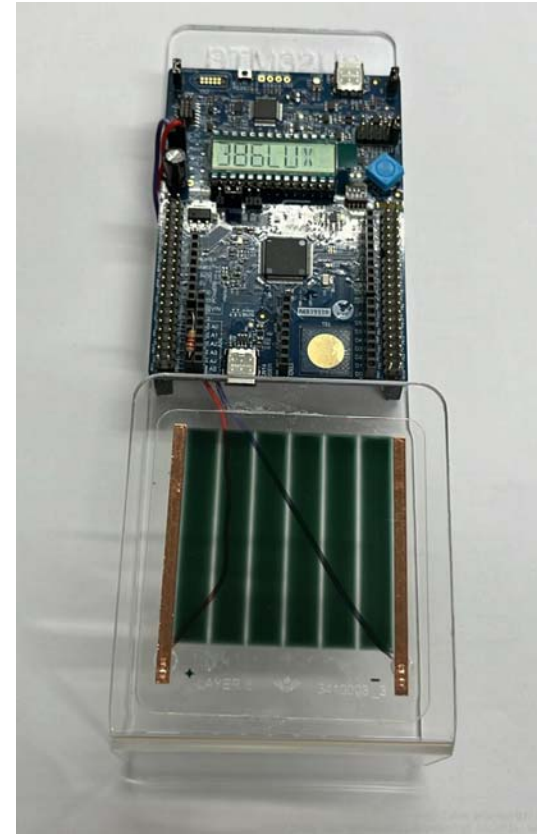
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Demo Overview

A successful collaboration between STMicroelectronics and Dracula Technologies has enabled the STM32U0 microcontroller to be powered by ambient light. By harvesting and converting ambient low light, sufficient energy was generated to power the STM32U0 and drive a temperature sensor. Additionally, by reading the current from the OPV and comparing it with embedded data, the microcontroller determined the surrounding illumination level.





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EnerHarv 2024 Workshop Demo Session: *Indoor PV Application Development Kit with Consumer Application Examples*



Presented By –

Joshua Wright, VP of Engineering

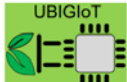
Ambient Photonics

joshua.wright@ambientphotonics.com

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Demo Overview



Application Development Kit (ADK)

- Detailed, Proper Characterization of Indoor PV Environment
- Real-time MPPT Data
- Data Black Box



Consumer Applications

- Remote Control
- Wireless Mouse





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EnerHarv 2024 Workshop Demo Session:

Energy Autonomous Wireless Sensor Node for Light Monitoring with LoRaWAN Connectivity

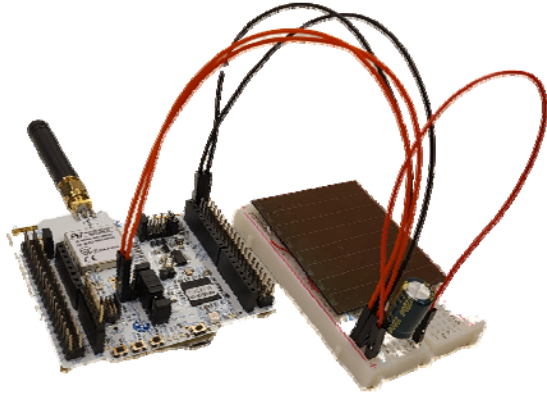


Presented By
Pietro Firpo, UNIGE – DITEN

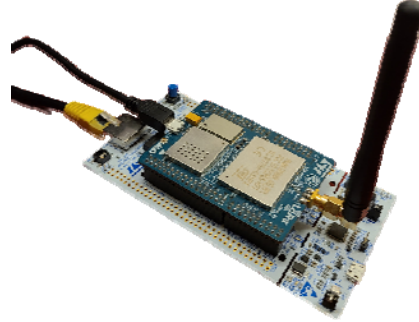
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Energy Autonomous Wireless Sensor Node for Light Monitoring with LoRaWAN Connectivity



STM32WL board + PV cell +
storage capacitor



LoRaWAN gateway
Connected to Internet



Dashboard



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EnerHarv 2024 Workshop Demo Session:

Ultra-Low-Power Energy-harvesting Beat Sensors with Security Features

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HOWEPOWER
Bodo's Power Systems



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Duy-Hieu Bui

Vietnam National University Hanoi
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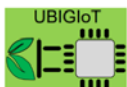
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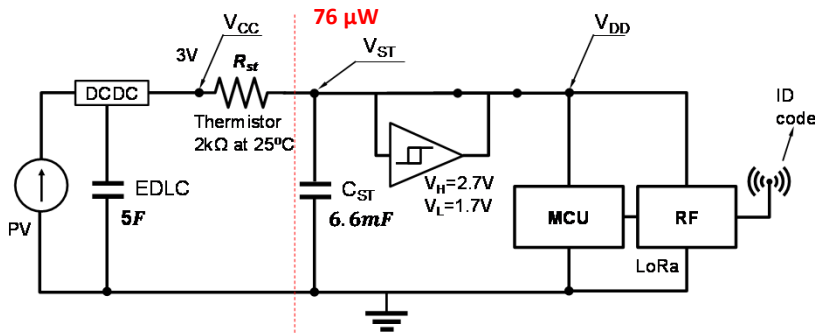


loLiPoP-IoT
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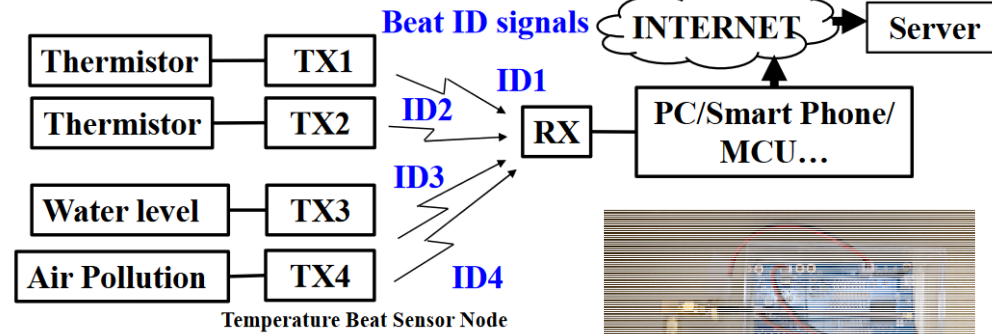


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Ultra-Low-Power Energy Harvesting Beat Sensors for Environment monitoring



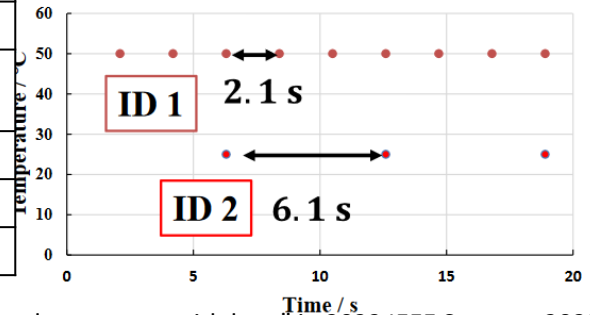
Power Beat Sensor Node



- Batteryless IoT sensor node
- Zero maintenance
- LoRa communication
- Credit Card Size
- Secure

Energy-Harvesting Beat Sensor

Average power consumption	76 μW
Frequency band	920 MHz
Communication Distance	5.25 km
Accuracy	± 0.097 $^{\circ}$C
Energy storage	5 F
Operation time	24h /365 days





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EnerHarv 2024 Workshop Demo Session:

Wave Energy Harvester for IoT Sensor Node

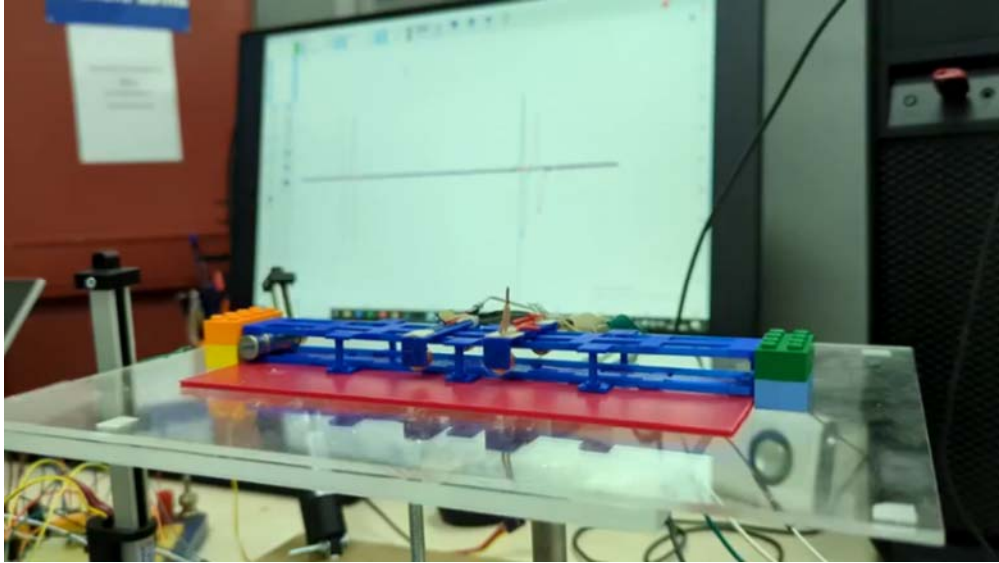


Presented By
Filippo Nicora, DIFI - DITEN

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Demo Overview: Wave Energy Harvester for IoT Sensor Node



- A cylindrical magnet is free to slide along a track
- A series of coils is positioned on either side of the track
- Electric current is generated by the Faraday effect

Objective: monitoring of river and marine waters that is increasingly important for environmental and service purposes.