EnSO
Energy for Smart Objects

PROJECT NEWS

ISSUE 2 / JANUARY 2018

Edito

To all readers, please receive my best wishes for 2018!

With the end of 2017 comes the end of the second year of EnSO project. As expected, new Autonomous Micro Energy Sources demonstrators were delivered last December. These hybridized flex boards composed of a NFC charger, a rechargeable micro battery and the relevant power management will allow all end users to finely tune their use cases. Moreover, these modules enable connections to several other harvesting devices.

This newsletter is mainly focused on harvesting technologies developed in EnSO. These were discussed in more details during a special workshop held last November by Gas Natural Fenosa in InnovaHub Barcelona, in which the EnSO Executive Board Meeting also took place.

Last but not least, you will also get a glance at who is our WP4 Assembly Leader, Corne!

Have a fruitful reading of this 2nd issue, and happy 2018 again, with plenty of success to EnSO in its future new configuration…All details to come soon !

Franck DOSSEUL.

Let's talk about harvesting.

Energy harvesting makes use of ambient energy (e.g., solar power, thermal energy, wind energy, salinity gradients, kinetic energy, etc.), to provide very small amount of power for **low-energy electronics,** such as:

- **Condition monitoring:** monitoring of large machineries, engines, plants and structures with wireless sensors
- **Building automation:** control of lighting, heating, air condition, sun blends
- **Logistics and Transport:** Tracking goods and assets by GPS modules
- **Wearables:** Monitoring of vital parameters

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Energy harvesting

- recharges batteries during operation
- enables unlimited stand-by and operation times, with no maintenance effort

EnSO will provide

- bendable and flexible solar cells, thermoelectric generators and vibration and mechanical harvesters
- thin-film batteries
- miniaturized power and battery management electronics

The benefits of energy harvesting are wireless power supply, low installation costs (no wires), no maintenance effort for battery replacement or charging, reduction of costs (moderate installation costs, but not maintenance effort), unlimited stand-by and operation time, operation in inaccessible locations, higher temperature range and finally environmental friendliness.

Energy harvesting in EnSO

Within EnSO, we are working on the following energy harvesting devices:

- **Thermoelectric Power Supply**

The principle is based on the heat difference between 2 points, using the Seebeck-Effect. The output voltage is proportional to the temperature difference between the top and the low plates.

Typical usages of TEG (thermoelectric energy) is wearables and sensors.

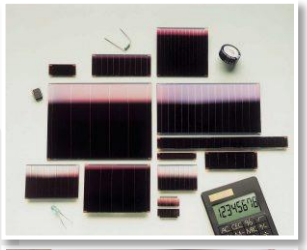
- **Mechanical Power Supply**

The principle is based on either mechanical deformation that produces a separation of charges (piezoelectric generators) or a combination of magnet and coil (electrodynamic (inductive) generators).

Typical usages of mechanical energy are tracking systems, flow meters, etc.

- **Solar energy Power Supply**

Main challenge of such harvesting which is already well known is to supply power under low light intensities (for instance indoor), so as to improve the autonomy duration of low consumption objects.



Energy Source	Challenge	Typical Impedance	Typical Voltage	Typical Power Output	Cost
Light	Conform to small surface area; wide input voltage range	Varies with light input Low kΩ to 10s of kΩ	DC: 0.5V to 5V [Depends on number of cells in array]	10µW-15mW (Outdoors: 0.15mW-15mW) (Indoors: <500µW)	**$0.50 to $10.00**
Thermal	Small thermal gradients; efficient heat sinking	Constant impedance 1Ω to 100s of Ω	DC: 10s of mV to 10V	0.5mW-10mW (10° C gradient)	**$1.00 to $30.00**
Vibrational	Variability of vibrational frequency	Constant impedance 10s of kΩ to 100kΩ	AC: 10s of volts	1µW-20mW	**$2.50 to $50.00**
RF & Inductive	Coupling & rectification	Constant impedance Low kΩs	AC: Varies with distance and power 0.5V to 5V	Wide range	**$0.50 to $25.00**

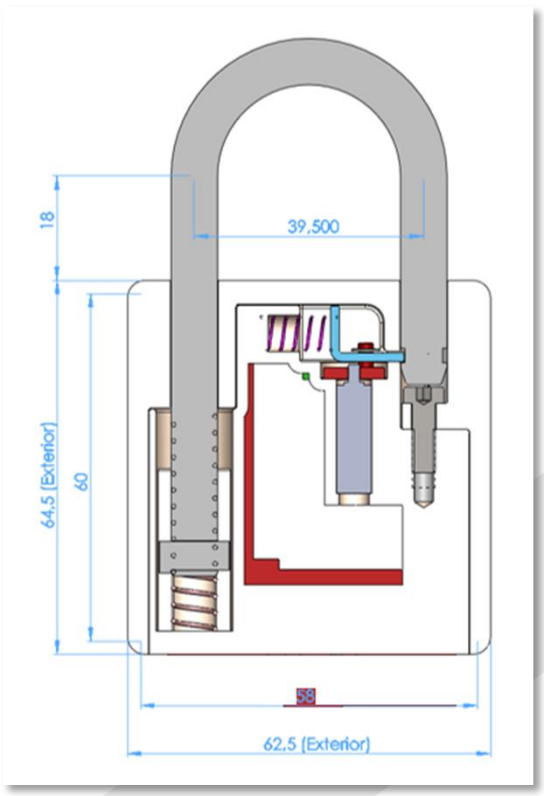
EnSO use case: Smart Lock

With Smart Locks, your smartphone is the key!

Smart Locks are electronic locking systems that can be opened with a phone, and for which users' accesses can be managed anywhere in the world.

Here we present two models: **a padlock** and a **security cylinder**.

In both cases, the innovative solution is designed for smartphones to control the lock, independently from electrical network or Wifi access. Moreover, it benefits from low power consumption and PVC energy harvesting systems which means that it does not need extensive maintenance effort. Thanks to the smart lock app, the person in charge can remotely control who has access to the lock, wherever she is.



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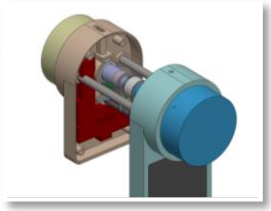
Upcoming events

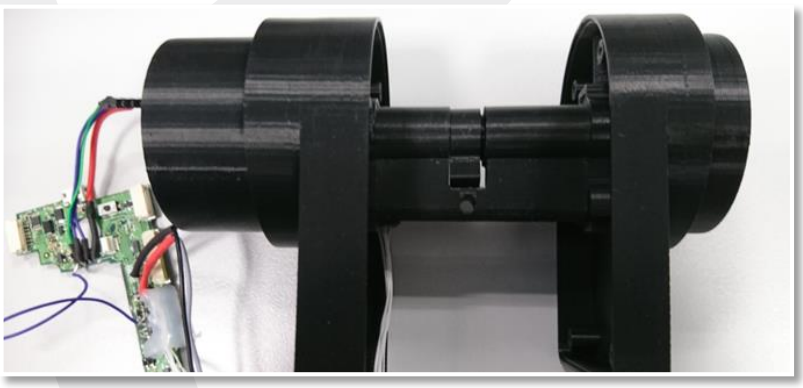
EnSO General Assembly, 15-16th of March 2018, Minatec Campus, CEA, Grenoble France.

LOPE-C conference, 13-15th of March 2018, Messe Munchen, Munich, Germany

More precisely, the lock and phone exchange data on the app through Near-Field Communications. Once connected, the IoT platform controls the user's access to the facilities and offers different services. The software security model is based on symmetric encryption algorithms, which enables the app to update its token every day and ensure that the user is able to open or deny the access of a particular Smart Lock.

Last but not least, security and sturdiness are as high as for current mechanical locks. On the one hand, the padlock offers the same resistance as one mechanical padlock with a shackle of metric 8. On the other hand, the security cylinder strongly prevents any attempt to dismount the lock. Indeed, to access the outside part with the screw, you need to get into the inside part, which can only be opened electronically by a valid user.





Low power, secure and independent from networks, these smart locks pave the way for new locking systems, and can already be seen as an ideal solution for isolated facilities.

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KEEP IN TOUCH

Our next newsletter will be released in April 2018!

Please contact our webmaster: fbrutin@ayming.com if you want to receive it automatically

Interview with Corne RENTROP, TNO

Corne Rentrop is a senior research scientist who works in the hybrid printed electronics group of the Holst Center, TNO. Corne is also WP4 leader of the EnSO project.

Tell me about yourself and your place of work.

Corne Rentrop: I have been working in TNO (the Netherlands Organization for applied scientific research) on materials science, and in the Holst Center for the past 2 years. The Holst Centre is an R&D independent open-innovative center, founded by both Imec and TNO. We focus on Wireless Autonomous Sensor Technologies and Flexible Electronics. It's located at the High Tech Campus in Eindhoven, the city built by Philips!

What do you mean? And how do you like it ?

C.R.: The campus is highly stimulating. It gathers more than 160 Institutes and companies, from SMEs to big names like Shimano for instance. It brings a very positive feeling of entrepreneurship. It's also very international, just as in the Holst Center. We count 26 nationalities for a staff of 250 people. It means there are a lot of social events and more importantly, very good food I'm encouraging researchers to come and work here, the atmosphere is very friendly and open-minded.

It seems like a good place to live in! Let's get into the EnSO project. What's your role in it?

C.R.: The WP4 of the EnSO project is the AMES (Autonomous Micro Energy Sources) assembly. Basically, we produce flexible electronic circuit boards by printing conductive ink on plastic foil. Thus electronic components are scalable at a low cost, since printed electronics can be easily produced at large scale with e.g. Roll-to-roll printing. The EnSO project focuses on energy for IoT (Internet of Object)... *(continue on next page)*

One of the aim of the IoT field is to create products that are autonomous, i.e. do not need an external source of power. In EnSO, we were able to produce a hybridized flexboard which includes an antenna and power management system, and is used as part of an Energy harvester for small connected objects. So far we have produced prototypes of the flexboard with state of the art industrial production methods. We have received very positive comments. After few alteration of the initial design, we were able to meet the specifications and we are hoping to produce at larger scale in the near future.

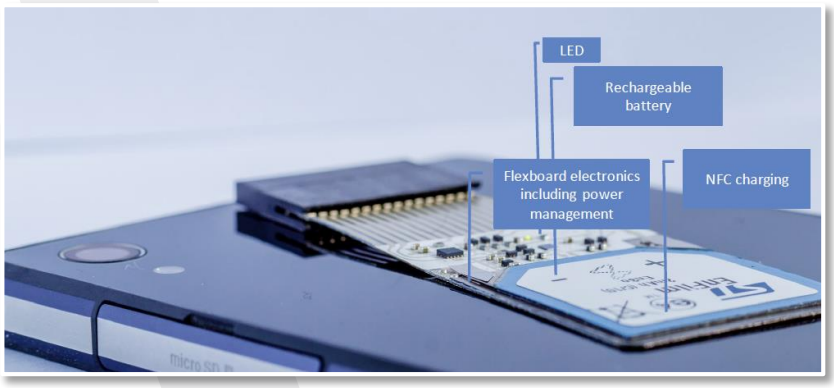
It's great news! It seems that thanks to this technology, you're entering the LOPE-C competition. Can you…

Read the full story on EnSO website.

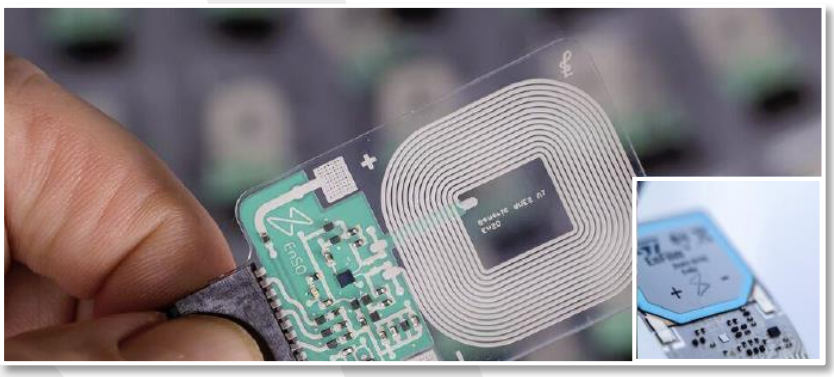
EnSO will be at LOPE-C

Large-area, Organic & Printed Electronics Convention, LOPE-C, is a world-known event in the field of printed and organic electronics.

Combining a conference and an exhibition, the event means to bridge Academic Research and Industrial needs. This conference is also the occasion to award the best innovative project among the OE-A competitors. This year EnSO is entering the competition thanks to its hybridized flexboard, an essential component of the energy harvesting chargeable batteries. Developed by TNO, in Corne Rentrop's group, the flexboard contains a NFC charger, a rechargeable micro battery and the relevant power management.



The potential applications of such technologies range from smart health to smart society and mobility.



Let's hope for the best and we wish them good luck !

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Project

Leader: Tours

36 Partners and 5 third parties
8 countries
Start: 1-1-2016
Duration: 48 months
Total investment: €M 82

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ECSEL Joint Undertaking
Electronic Components and Systems for European Leadership

EnSO has been accepted for funding within the Electronic Components and Systems for European Leadership joint undertaking in collaboration with the European Union's H2020 framework programme (H2020/2014-2020) and National Authorities, under grant agreement n° 692482