DEFENSIE
LA DÉFENSE

Royal Higher Institute for Defence

Defence-related Research Action - DEFRA

ACRONYM: MONA

Title: Miniaturized motion-triggered energy harvester for wireless communication and battery recharging

Duration of the project: 01/01/2022 - 31/12/2023

Budget: €399.545

Key words: energy harvesting and power management, sensor node, battery recharging

PROJECT DESCRIPTION

The MONA project aims to design a Small Energy Harvester System (SEHS), scavenging mechanical energy and converting it into electrical energy in order to power a communication unit or a battery charging device. While most of the mechanical energy harvesters are dedicated to operate at a specific frequency (vibrating mass), the proposed system has the significant advantage to work in an extended frequency range, as well as to be activated by a variety of movements, including a single actuation from a finger or foot depressing a push-button, mechanical vibration during motorized transportation or a sudden shock. The SEHS will consist in a small cylindrical device with a diameter of about 30 mm and a thickness of about 10 mm.

Depending on the intended use, the output power can be used either to supply a RF communication unit (wireless remote control, alert button, intrusion detector, etc.) or to provide a DC voltage to external devices (battery charging). Compared to miniaturized photovoltaic panels, the proposed system has the advantage of generating energy instantly, day and night, and using an unobtrusive and miniaturized harvester. Additionally, the system has an extended temperature range and requires neither logistics nor maintenance contrary to systems powered by batteries which have to be replaced or recharged regularly. Finally, it is more robust to austere environmental conditions compared to a dynamo type appliance, as there is no rotating part nor pieces undergoing large displacements.

As most of the electromagnetic energy harvesters, the system to be developed in MONA is based on permanent magnets and coils combination. However, it has the particularity of not converting energy immediately, but storing it in a spring in the form of mechanical energy. The energy conversion is only performed when a sufficient amount of energy is available in the spring, which significantly increases the conversion efficiency.

In the current proposal, the development is multidisciplinary and the complementarity between Microsys and FN Herstal constitutes a key asset: Microsys tackles the energy harvesting and power management principles while FN Herstal's expertise in RF communications applied to the defence

sector will be used in developing the wireless communications capabilities of this device. The fabrication and integration involve micro-assembly but also precision machining, expertise which is present at Microsys and FN Herstal respectively. The experimental characterization will be allocated between Microsys and FN Herstal based on their respective know-how, the availability of equipment and the presence of dedicated test facilities. Furthermore, FN Herstal's expertise in small arms up to heavy weapons as well as their in-depth knowledge of military standards, such as those pertaining to wireless communication, testing and production capabilities is a valuable asset to this project.

The MONA research project will strengthen the partners' expertise in the energy harvesting field. Microsys laboratory is already involved in more than five research projects consisting in developing energy harvesting systems for various applications. However, in addition to the specificity of the target application case, MONA project requires a slightly higher target TRL level, which will allow the technology to be validated further, in partnership with a recognized industrial partner that will support the validation of the system. It is expected that the research will lead to high-level scientific publications, increasing the reputation of the laboratory and its chances of participating in international research projects in the nearby future. The company FN Herstal, considered as a global reference in the world of light firearms, will benefit from the project as it has a particular application case related to mechanical energy harvesting. Finally, Belgian Defence will also benefit from the joint results as it will be able to provide inputs during the project and it will be kept updated about the latest developments in the field of energy harvesting.

CONTACT INFORMATION

Coordinator
Jean-Michel Redouté
University of Liège – Microsys Laboratory
e-mail: jean-michel.redoute@uliege.be

Partner
Patrick Heins
FN Herstal
e-mail: patrick.heins@fnherstal.com

LINK(S)

http://www.microsys.uliege.be/projects#mona