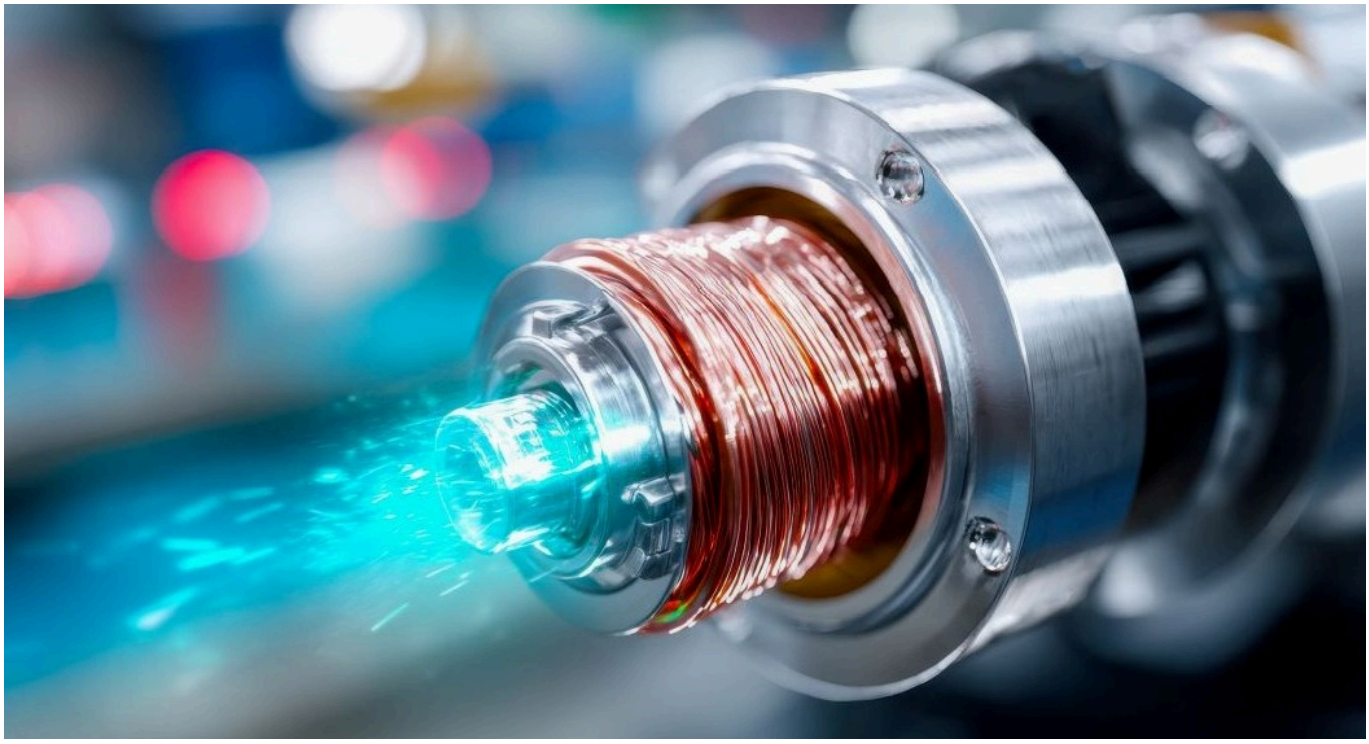
TECH OFFER

Self-Powered Energy Harvesting Technology for Wireless IoT Monitoring



KEY INFORMATION

TECHNOLOGY CATEGORY:
Manufacturing - Assembly, Automation & Robotics
Infocomm - Internet of Things
Energy - Waste-to-Energy
Electronics - Actuators

TECHNOLOGY READINESS LEVEL (TRL): TRL6
COUNTRY: NETHERLANDS
ID NUMBER: TO175424

OVERVIEW

The rapid growth of IoT and automation across industries has transformed operations with real-time monitoring and intelligent decision-making. However, ensuring a reliable power supply for every IoT monitoring system remains a major challenge, as frequent battery charging or replacement drives up costs, causes downtime, and impacts sustainability, underscoring the need for innovative energy solutions.

This energy harvesting technology generates reliable, event-based electrical pulses directly from motion or changes in magnetic fields. Unlike batteries, which require periodic replacement, or more familiar energy harvesters that rely on environmental conditions such as light or vibration, this approach provides a consistent and maintenance-free energy source triggered by movement. The pulses can power ultra-low-energy electronics including microcontrollers, sensors, and wireless transmitters, enabling truly autonomous IoT monitoring systems. This makes it possible to deploy sensors and monitoring devices in locations

where battery access or replacement is impractical, such as sealed enclosures, remote installations, or industrial equipment. The solution addresses the growing need for sustainable alternatives to batteries in IoT, offering cost savings, improved reliability, and reduced environmental impact.

This energy harvesting technology has use cases in rotary actuators. The technology owner is looking to co-develop this technology and test bed on more use cases with partners who design and manufacture IoT or other devices. Other potential partners could be system integrators or end users looking to customise product development for scale.

TECHNOLOGY FEATURES & SPECIFICATIONS

This technology consist of sensors can be triggered by alternating magnetic fields caused by different types of motion - rotational, linear, ferromagnetic proximity or electromagnetically. The trigger results in the production of consistent pulses, which can be easily registered and counted.

- **Electromagnetic generation**: At the heart of the technology is a compact magnetic component that produces a sharp voltage pulse each time the surrounding magnetic field changes polarity. It produces 9 µJ of energy per pulse/magnetic event with a triggering field of 6-8mT. This effect provides both energy generation and event detection in a single mechanism. The pulses are high enough to charge capacitors, which then power low-energy devices or wireless transmission modules.
- **No moving mechanical parts:** Unlike other electromagnetic solutions, it does not contains moving mechanical parts with no additional springs or vibrating levers required to compensate for slow magnetic field changes. This eliminates wear and tear while ensuring a consistent amount of energy per movement event, regardless of speed.
- **Campatible with non-volatile memory and wireless communication modules:** Enable event-driven data logging and transmission.
- **Compatible with rotary and linear motion systems:** Its modular design allows flexible integration into both rotary and linear motion systems, making it adaptable across a wide variety of applications.

POTENTIAL APPLICATIONS

The technology can be applied wherever long-life, maintenance-free IoT sensing is required, including:

- Manufacturing and industrial condition monitoring in rotating or moving machinery
- Smart meters and utility systems requiring sealed or inaccessible enclosures
- Building automation devices for access monitoring and energy management
- Logistics tracking and supply chain monitoring of motion or environmental events
- Remote agricultural and environmental sensors in hard-to-reach areas
- Healthcare devices using lower frequency electromagnetic waves that can be transmitted through the skin without any damage to human tissue

MARKET TRENDS & OPPORTUNITIES

The rapid growth of IoT is constrained by the limitations of batteries, including cost, maintenance, and environmental impact. Energy harvesting technologies are increasingly sought to overcome these barriers. This approach stands out by providing compact, motion-driven power generation that is reliable, consistent, and independent of ambient conditions. Its dual function of powering devices while simultaneously detecting events offers unique design and cost advantages over conventional solutions.

UNIQUE VALUE PROPOSITION

- **Stable, event-based energy output at irregular motion speed:** Compared with vibration or inductive harvesters, the technology produces stable energy output even at low or irregular motion speeds. Its ability to simultaneously harvest energy and detect events reduces the need for additional components, simplifying designs and lowering costs. This makes it an ideal enabler for sustainable, scalable IoT deployments.
- **Battery-independent operation:** This technology offers significant advantages over battery-based systems by eliminating the need for replacement or recharging.
- **Low maintenance costs:** System lifetimes are extended, and devices can be deployed in sealed or remote environments without concern for accessibility.