

SYSTEMS FOR PULSE-MODE INTERROGATION OF WIRELESS BACKSCATTER COMMUNICATION NODES

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PATENT STATUS

Country	Type	Number	Dated	Case
Patent Cooperation Treaty	Published Application	WO 2024/215509	10/17/2024	2023-051

Additional Patent Pending

BRIEF DESCRIPTION

Measurement of electrical activity in nervous tissue has many applications in medicine, but the implantation of a large number of sensors is traditionally very risky and costly. Devices must be large due to their necessary complexity and power requirements, driving up the risk further and discouraging adoption.

To address these problems, researchers at UC Berkeley have developed devices and methods to allow small, very simple and power-efficient sensors to transmit information by backscatter feedback. That is, a much more complex and powerful external interrogator sends an electromagnetic or ultrasound signal, which is modulated by the sensor nodes and reflected back to the interrogator. Machine learning algorithms are then able to map the reflected signals to nervous activity. The asymmetric nature of this process allows most of the complexity to be offloaded to the external interrogator, which is not subject to the same constraints as implanted devices. This allows for larger networks of nodes which can generate higher resolution data at lower risks and costs than existing devices.

SUGGESTED USES

Sensing and manipulation of electrical activity in nervous tissue such as by neural interfaces.

This technology may be useful in any setting where there is a need for wireless communication to small or simple nodes. This includes inexpensive and distributed nodes that are relatively low bandwidth, such as communication with highly miniaturized implantable wireless biosensors.

Application areas may include: biomedical implants, neural interfaces, ambient sensors in buildings, internet-of-things, industrial internet-of-things, cyber-physical systems, industry 4.0, automation, sensors in manufacturing, product tracking, wireless sensors embedded in products, wireless sensors in manufacturing product stream, wireless devices freely floating in fluid product pipelines, wireless devices freely floating in oil and gas pipelines, very inexpensive or disposable sensor nodes, applications similar to current use-cases of RFID tags but interrogating multiple sensors simultaneously without having to rely on frequency-division multiplexing or code-division multiplexing, and other applications for wireless sensor networks.

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OTHER INFORMATION

KEYWORDS

Backscatter communication,
Implantable sensors, Neural
interfaces, Demodulators, MIMO,
Wireless interrogation, Pulse-echo,
Backscatter, Ultrasound, Medical
implants

CATEGORIZED AS

» **Communications**

» Wireless

» **Computer**

» Software

» **Engineering**

» Engineering

» **Imaging**

» Medical

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» Devices

» Diagnostics

» Imaging

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ADVANTAGES

The asymmetric nature of backscatter communication enables the sensor nodes to be much smaller and cheaper and with lower power requirements than traditional technology allows. The lower power requirements of these nodes enables a longer recording time, while the small size reduces the risks associated with implantation. The use of ultrasonic rather than electromagnetic communication also enables high efficiency communication with small nodes, owing to the smaller wavelength of sound waves than EM waves at a given frequency.

RELATED MATERIALS

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