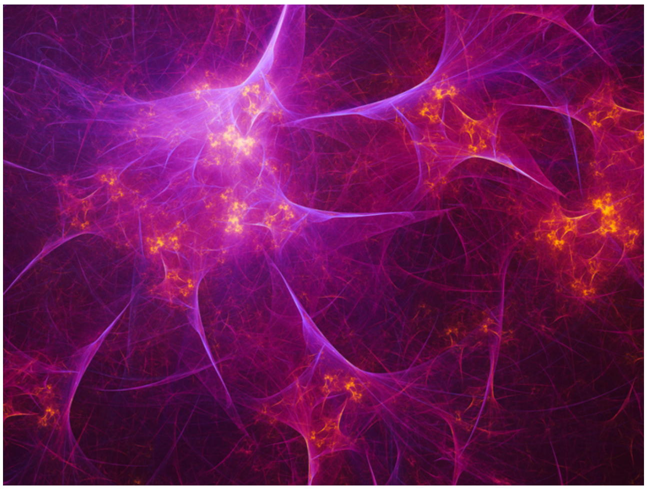
A Wireless Neural Recording System with Two-Step Communication and Power Delivery

TECHNOLOGY NUMBER: 2020-211



OVERVIEW

Wireless neural recording system using infrared for power and data

- Low-power, wireless communication avoids tissue damage and infection risks
- Brain-machine interfaces, neural prosthetics, neurological research

BACKGROUND

Traditional neural recording systems for brain-machine interfaces have relied on wired connections for power and data transmission, posing significant challenges. The presence of wires increases the risk of infection, tissue damage, and potential cerebrospinal fluid leaks, making these systems unsuitable for long-term implantation. Efforts to develop wireless systems have led to the use of radio frequency (RF) and ultrasonic methods; however, these approaches face limitations. RF systems often exceed safety limits and can only safely transmit limited power, while ultrasonic systems require larger components, such as transducers, that restrict miniaturization. Near-infrared (NIR) technology has emerged as a promising alternative, offering efficient power and data transmission with a substantially lower risk. Despite advancements, existing NIR systems typically support limited channels and rely on surface electrodes that may either affect data quality or cause tissue damage if inserted. Hence, a need exists for a more effective and minimally invasive wireless neural recording system that

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Category

Hardware
Engineering & Physical Sciences
Semiconductors, MEMS, and Electronics

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facilitates accurate neural data capture for extended periods.

INNOVATION

Researchers at the University of Michigan have developed a compact, wireless neural recording integrated circuit (IC) employing near-infrared (NIR) technology for power and data telemetry. The system comprises minute-sized motes positioned in the brain's sub-dural space, receiving power from a repeater unit via NIR light absorbed by a photovoltaic cell. A carbon fiber probe penetrates brain tissue to capture neural signals, which are processed on-chip using ultra-low power front-end circuits to compute spiking band power (SBP). This reduces power consumption by 920 times compared to typical systems while maintaining decoding accuracy of finger positions. The IC's LED sends data back to the repeater using a unique chip ID, enabling differentiation between multiple motes. This system significantly minimizes chronic scar formation and tissue damage, addresses size constraints of existing technology, and expands real-world applications in neuroscience research, brain-machine interfaces, and long-term neural prosthetic use through effective, minimally invasive long-term monitoring of neural activity.

ADDITIONAL INFORMATION

REFERENCES

J. Lim et al., "26.9 A 0.19×0.17mm2 Wireless Neural Recording IC for Motor Prediction with Near-Infrared-Based Power and Data Telemetry," 2020 IEEE International Solid-State Circuits Conference - (ISSCC), San Francisco, CA, USA, 2020, pp. 416-418, doi: 10.1109/ISSCC19947.2020.9063005

INTELLECTUAL PROPERTY

US11911128 "Wireless neural recording devices and system with two stage RF and NIR power delivery and programming"