



Office of Technology Transfer New Patent Announcement

PATENT: 12,369,831

Battery-Free Wearable Sensors Capture Differential Body Signals

Continuous physiological monitoring is often constrained by wires, batteries, bulky electronics, and limited wireless range. The patented wireless resistive analog passive (WRAP) platform uses inductively coupled printed spiral coils to capture body signals without a battery or digital chip at the sensing site.

Mirror-opposed conjugate sensor coils cancel common-mode signals while preserving differential signals, enabling passive ECG/EKG, EMG, EEG, and EOG sensing without powered differential amplification. A passive paired-coil extender carries power and sensor signals farther across the body, allowing more flexible reader placement.

APPLICATIONS

- Wearable ECG and ambulatory cardiac monitoring
- EEG, EMG, EOG, and other differential biopotential sensing
- Battery-free patient monitoring patches and garments
- Long-duration home, rehabilitation, and telehealth monitoring
- Implantable or hard-to-access physiological sensors
- Veterinary monitoring and research instrumentation
- Multi-parameter platforms for heart rate, respiration, pulse oximetry, and temperature

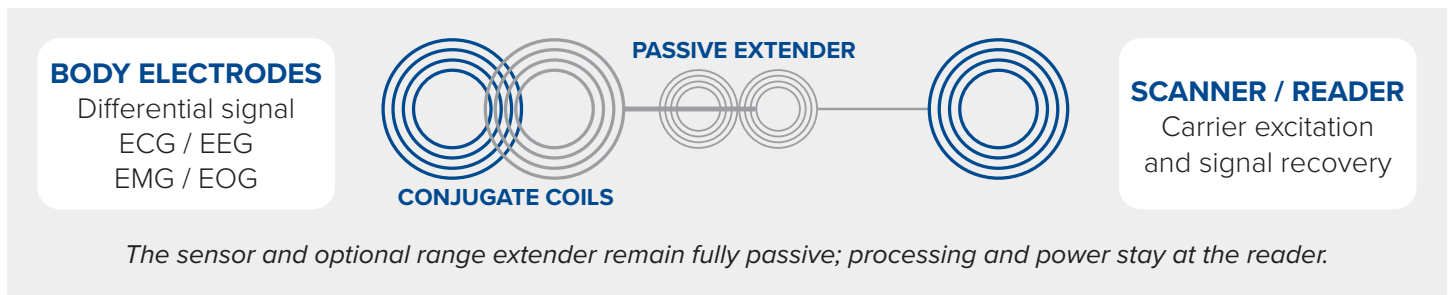
LICENSING OPPORTUNITY

The University of Memphis is seeking partners to develop, validate, license, and translate this battery-free sensing platform.

ABOUT THE OFFICE OF TECHNOLOGY TRANSFER

Research and innovation are rewarding, but it is the application of those ideas that truly brings them to life. The Office of Technology Transfer (OTT), housed within the FedEx Institute of Technology, guides innovations from big ideas to licensed intellectual property and breakthrough commercial products. To explore licensing and collaboration opportunities, contact the University of Memphis OTT.

PASSIVE SIGNAL CAPTURE WITH FLEXIBLE READER PLACEMENT



ADVANTAGES

- Battery-free sensing element supports thinner, lighter, and potentially lower-maintenance wearables
- Captures differential biopotentials without a powered differential amplifier at the sensor
- Analog, chip-free sensor architecture may reduce component count and failure points
- Conjugate coils suppress common-mode content while transmitting differential information
- Passive paired-coil extender increases separation between the body sensor and scanner
- Compatible with printed planar coils, flexible wiring, and garment-integrated form factors

TECHNOLOGY

Two matched planar spiral coils are arranged in mirror-opposite orientation at the sensor. Each coil produces an induced magnetic field; common-mode fields cancel, while differential inputs alter the paired sensor loading and modulate the carrier received by the scanner. The architecture can use MOSFET-based resistive transduction for microvolt-level signals.

An optional battery-free range extender uses paired coils connected by flexible wires, with optional tuning capacitors. It can be worn on or integrated into clothing so a chest sensor communicates with a scanner placed at the waist, belt, or pocket.

INVENTORS

LEAD INVENTOR



Bashir I. Morshed, Ph.D.

*Assistant Professor of Electrical and Computer Engineering
Director of ESARP and BioSens laboratories
University of Memphis*

Dr. Morshed's research centers on embedded systems and wearable biomedical devices, including passive wireless sensors and neurological monitoring.

COLLABORATORS

- Mohammad Abu-Saude

Assignee: The University of Memphis Research Foundation

Filed: April 28, 2019 | **Issued:** July 29, 2025