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Systems, Methods, and Media for Determining Fetal Photoplethysmography Information from Non-Invasively Obtained Mixed Photoplethysmography Signals

Tech ID: 34460 / UC Case 2026-414-0

ABSTRACT

Researchers at the University of California, Davis have developed a system and method for accurately extracting fetal photoplethysmography information from mixed maternal-fetal signals obtained non-invasively through the maternal abdomen.

FULL DESCRIPTION

This technology involves systems, methods, and media designed to non-invasively monitor and analyze fetal photoplethysmography (PPG) signals embedded within mixed maternal-fetal signals captured by a transabdominal optical probe. By using multiple wavelengths of near-infrared light and sophisticated signal processing techniques—including phase detection of fetal heartbeats, signal segmentation, alignment, and averaging—fetal physiological parameters such as blood oxygen saturation and arterial blood pH can be accurately determined. The technology overcomes challenges posed by weak fetal signals, overlapping maternal cardiac signals, and noise, enabling continuous and objective fetal well-being assessment during labor and delivery.

APPLICATIONS

▶ Intrapartum fetal monitoring for improved assessment during labor and delivery.

▶ Non-invasive fetal oxygenation and acid-base status monitoring in hospitals and birthing centers.

▶ Supplementary tool to conventional cardiotocography providing continuous, objective fetal well-being data.

▶ Integration into fetal monitoring devices for real-time clinical decision support.

▶ Wearable maternal-fetal monitoring systems enabling improved prenatal care.

FEATURES/BENEFITS

▶ Enables non-invasive, continuous monitoring of fetal physiological parameters through the maternal abdomen.

▶ Utilizes advanced signal processing to isolate fetal signals from maternal signals and noise.

▶ Reduces false positives and unnecessary interventions compared to conventional cardiotocography.

▶ Estimates critical fetal parameters, such as oxygen saturation and blood pH, to enhance clinical decision-making.

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OTHER INFORMATION

KEYWORDS

blood oxygen saturation, electrocardiogram, fetal blood pH, fetal heartbeats, fetal photoplethysmography, non-invasive monitoring, photoplethysmography signals, signal processing, transabdominal fetal oximetry, wearable fetal monitoring

CATEGORIZED AS

▶ **Optics and Photonics**

▶ All Optics and Photonics

- ▶ Employs neural network models for accurate prediction of fetal blood oxygen saturation.
- ▶ Integrates with existing fetal heart rate monitoring sensors to improve phase detection.
- ▶ Problems Solved Overcomes difficulties in non-invasively separating and accurately measuring weak fetal PPG signals within mixed maternal-fetal data.
- ▶ Decreases high false positive rates and variability associated with traditional fetal heart monitoring methods.
- ▶ Replaces invasive and intermittent biochemical fetal health tests like blood pH and lactate analysis.
- ▶ Addresses challenges from tissue light attenuation, motion artifacts, and in-band noise during fetal signal extraction.

PATENT STATUS

Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Accurate, Non-Invasive Fetal Arterial Oxygen Saturation and Blood Ph Measurement via Diffuse Optics
- ▶ Fetal Oximetry Measurement via Maternal Transabdominal Spectroscopy
- ▶ Method and System for Signal Separation in Wearable Sensors with Limited Data (with Applications to Transabdominal Fetal Oximetry)