A new approach to optical sensing

Conventional pulse oximeters based on photoplethysmography (PPG) rely on two-dimensional, point-based optical measurements that are vulnerable to motion artefacts, skin tone interference and poor perfusion. These limitations reduce signal quality and contribute to well-documented bias in real-world use.

Carelight's Opto Physiological Monitoring (OPM) technology applies a three-dimensional, multispectral optical sensor design that interrogates a volume of tissue, improving vessel interaction and delivering high-quality, multi-wavelength physiological signals across conditions.

The following section outlines the limitations of conventional PPG sensing and explains how OPM's 3D optical system addresses them.

Limitations of conventional PPG sensing

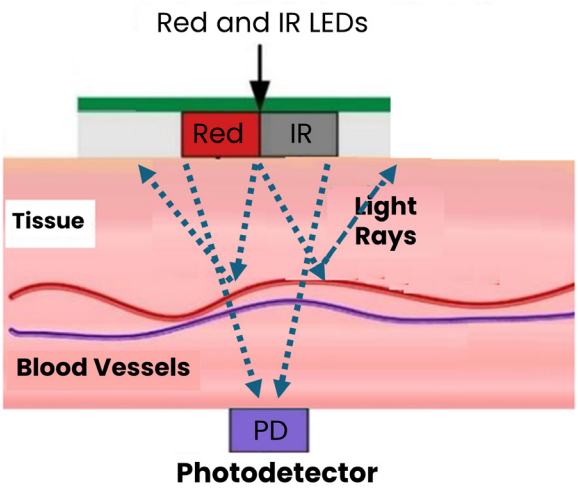
Healthcare systems have a long history of reported bias in medical devices, including optical sensor-based pulse oximeters. Data from the Covid-19 pandemic showed that pulse oximeters can overestimate true oxygen saturation in black people, with diagnoses of hypoxaemia approximately three times more likely to be missed than in white patients.

Existing pulse oximeters, based on the principles of photoplethysmography (PPG), have been used to monitor vital signs such as heart rate and blood oxygen levels for over 40 years. However, they have well-known reliability issues. Sensor performance is undermined by motion artefacts, skin-tone-related optical interference and poor blood perfusion, typically resulting in poor signal quality.

Existing PPG devices operate on a two-dimensional design basis, using point or direct-line measurements. This reduces the probability of interacting with larger blood vessels and contributes to lower signal quality.

Carelight's novel optical sensor technology, OPM, overcomes these limitations by applying a three-dimensional, multispectral illumination sensor design that interrogates a volume of tissue. This improves the probability of interacting with larger blood vessels and enhances robustness against motion interference, resulting in high-quality, multi-wavelength signals.

Conventional PPG sensor design



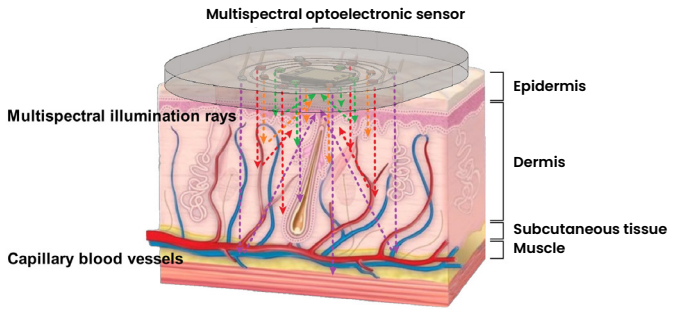
A generic PPG sensor module

- **Existing 2D sensors rely on point or direct-line measurement**
- **Low probability of interacting with larger blood vessels**
- **Well understood signal quality issues**
- **Recognised as problematic across all skin tones**

OPM-based Weartech sensor platform

Proprietary OPM novel sensor platform

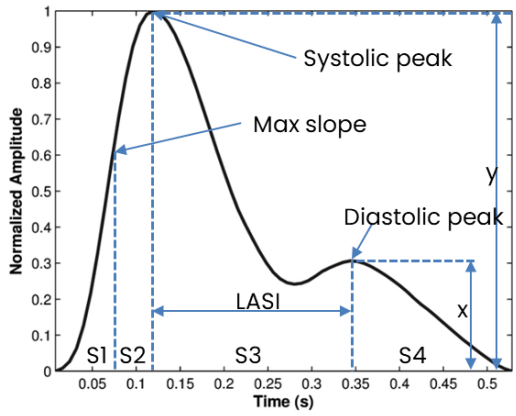
- 3D multispectral illumination Opto Physiological Monitoring (OPM) sens or design
- Interrogates a volume of tissue encapsulating larger blood vessels
- High-quality, multi-wavelength signals
- Performance maintained across all skin tones



OPM 3D optical sensing approach

OPM high-quality signals enable cardiac feature analysis for:

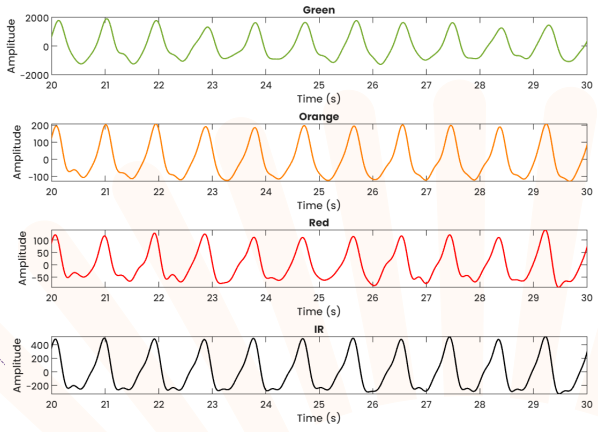
- Robust vital sign monitoring, overcoming motion, skin tone and perfusion problems
- Expanding optical sensing into cardiovascular diagnostic and preventative health applications



High-fidelity 3D optical sensing

OPM 3D sensors built on new science with high fidelity signal quality

- Optical signal quality maintained during motion, in low perfusion and across all skin tones.
- Confluence of sensor design, signal processing and ML/AI algorithms.
- Multiple form factors optimised for specific clinical applications.
- High signal quality and cardiac feature analysis open new product opportunities.



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