Researchers discover a more accurate way of checking blood flow in type 2 diabetes patients

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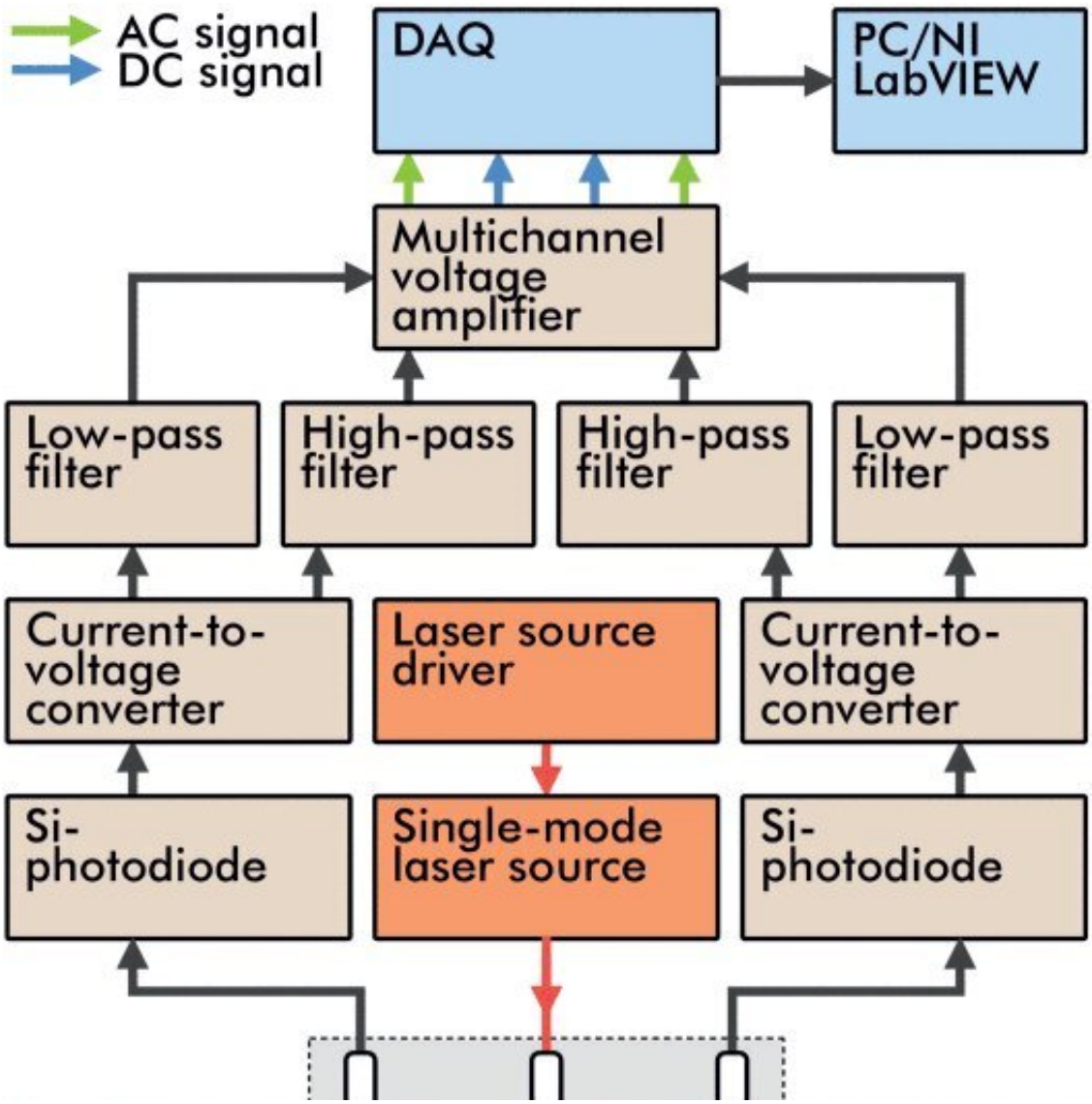

Flowchart of the developed experimental setup for LDF measurements. Credit:

IEEE Transactions on Biomedical Engineering (2022). DOI: 10.1109/TBME.2022.3181126

Aston University scientists have discovered a more accurate way of checking the blood flow in the feet of patients with type 2 diabetes.

Using lasers, their findings have resulted in improved accuracy in detecting tiny changes in microcirculation—the smallest vessels within the circulatory system.

Changes in flow at this level can affect whether tissue lives or dies. People with type 2 diabetes can be at risk of foot amputations due to circulatory complications caused by their condition.

Often a light—or photonic—technology called laser Doppler flowmetry (LDF) is used to monitor blood-flow in the skin. Developed in the late 1970s this method relies on averages of blood flow, therefore isn't always accurate.

Now, Aston University researchers have suggested a new approach to process LDF light signals that is more precise.

The research is described in "Diagnosis of Skin Vascular Complications Revealed by Time-Frequency Analysis and Laser Doppler Spectrum Decomposition," which is published in the journal *IEEE Transactions on Biomedical Engineering*. In recognition of the innovation and importance of the developed approach, the editorial board of the journal selected the paper as a featured article in the field.

Currently, LDF measures the blood perfusion—a quantity proportional to an average volume of blood flowing through an average volume of

tissue per an average unit time.

However, the new method separates the LDF signals allowing blood flow to be measured in a specific area of the vascular bed such as capillaries or veins.

The proposed approach has a great potential to be incorporated in existing bedside and wearable LDF-based devices for the more advanced clinical diagnosis of blood flow and blood flow microcirculation.

The new approach underwent tests on both healthy volunteers and pilot clinical trials on diabetes patients by applying a probe to their skin. The new method showed a significant improvement in the diagnostic accuracy of detection of microvascular changes in the skin of the feet in patients with type 2 diabetes, as well as age-specific changes.

The research was led by Professor of mechanical, biomedical and design engineering, Igor Meglinski and Dr. Viktor Dremen of Aston Institute of Photonic Technologies (AIPT).

Professor Meglinski said, "We're delighted to have found a more accurate method of blood flow diagnosis in skin that, we believe, can help people with diabetes. In the future this technique could pave the way for more precise imaging of blood flow in the brain and other biological tissues."

More information: Evgeny Zherebtsov et al, Diagnosis of Skin Vascular Complications Revealed by Time-Frequency Analysis and Laser Doppler Spectrum Decomposition, *IEEE Transactions on Biomedical Engineering* (2022). DOI: 10.1109/TBME.2022.3181126

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