

A New Handheld Cuffless Photoplethysmography Sensor for Continuous Blood Volume Measurement

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A new blood-flow volume (BFV) sensor device is designed and implemented for assessing quality of arteriovenous fistula in hemodialysis patients via noninvasive reflectance-type photoplethysmography (PPG). BFV is nowadays in clinic practices evaluated using an ultrasound Doppler monitor, which is expensive, bulky, and can only be operated by well-trained medical personnels. This study is devoted to develop a low-cost, small-sized, portable, and easy-to-use PPG sensor that is capable of continuous measurement of BFV. New designs of front-end analog circuits, signal processing, and an intelligent neural network calibration method are employed to finally achieve high correlation ($R^2 = 0.7176$), as opposed to the ultrasound Doppler monitor, with the root-mean-squared errors successfully controlled under 289 ml/min.