Patent Search

Invention Title	Low-Latency FPGA Digital Filters To Cancel Biomedical ECG Noise
Publication Number	20/2026
Publication Date	15/05/2026
Publication Type	INA
Application Number	202641057366
Application Filing Date	06/05/2026
Priority Number	
Priority Country	
Priority Date	
Field Of Invention	BIO-MEDICAL ENGINEERING
Classification (IPC)	A61B 5/00, A61B 5/352, A61B 5/0402, A61B 5/0245, A61B 5/366

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Abstract:

The present disclosure relates to systems and methods, and provides Low-Latency FPGA Digital Filters for processing electrocardiogram signals obtained from biome or stored datasets. The Low-Latency FPGA Digital Filters includes an ECG signal input stage (102), a digital filtering module (104), a high-pass filter (106), and a low-pas The ECG signal input stage (102) is configured to receive electrocardiogram signals from biomedical sensors or stored datasets. This configuration supplies electrocar signals containing baseline wander, power line interference, muscle noise, and motion artifacts to the digital filtering module (104), which processes the signals throu filter stages implemented on a Field Programmable Gate Array platform to produce a filtered ECG output signal (116) retaining the P-wave, QRS complex, and T-wave latency.

Complete Specification

Description:TECHNICAL FIELD
[001] The present invention relates to biomedical signal processing, and more particularly to Low-Latency FPGA Digital Filters for reducing noise in electrocardiogra signals through hardware-implemented cascaded digital filtering using Field Programmable Gate Array platforms and Verilog Hardware Description Language.
BACKGROUND
[002] Electrocardiogram signals constitute a primary diagnostic tool for the assessment of cardiovascular conditions including arrhythmias, myocardial infarction, a related cardiac disorders. These signals are bioelectrical in nature and capture the electrical activity of the heart over time, encoding clinically significant waveform f including the P-wave, QRS complex, and T-wave. Accurate acquisition and interpretation of these features is essential for timely and reliable cardiac diagnosis in bot clinical and ambulatory settings. The growing adoption of wearable cardiac monitoring devices, telemedicine platforms, and continuous patient monitoring systems substantially increased the demand for efficient, real-time electrocardiogram signal processing.
[003] During acquisition, electrocardiogram signals are susceptible to several categories of noise and interference. Baseline wander, typically caused by patient resp or electrode movement, introduces low-frequency drift that may obscure the isoelectric line and distort amplitude measurements. Power line interference, typically occurring at about 50 Hz or about 60 Hz, superimposes periodic electrical noise on the signal. Muscle artifacts and motion-related noise introduce broadband high-frequency disturbances. These noise sources may coexist simultaneously during a single recording session, and their combined effect may substantially degrade th diagnostic utility of the acquired signal.
[004] Conventional software-based filtering approaches have been employed to address these noise sources. Such approaches may utilize digital infinite impulse re

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