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Flexible Potentiostat Readout Circuit for Electrochemical Sensors
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Abstract
Personalised health wearables reach their full potential when sensors are integrated with its interfacing system. Recent approaches have primarily focused on the development of readout circuits limited to the electrochemical chip and basic signal conditioning components. However, integrating a readout circuit with a microcontroller offers significant advantages such as enhanced data processing capabilities. Other than incorporating a microcontroller within the readout circuit, we also designed the entire potentiostat system on a flexible polyimide substrate, making it suitable for wearable applications. In this work, we describe the design, fabrication and testing of a flexible potentiostat readout circuit for electrochemical sensors. The core of the interface circuit is two chips, a microcontroller ATSAMD21G18A-MUT (Microchip Technology) and a programmable analog front-end integrated circuit from Texas Instruments. These chips along with a voltage regulator, resistors and capacitors were integrated onto a single, flexible, printed circuit board. To verify the functionality of the flexible readout circuit, it was connected to an electrochemical sensor and Cyclic Voltammetry (CV) was performed. The separation between peaks (ΔEp), were measured using the flexible board and compared with a commercial potentiostat (Emstat Pico). EmStat Pico has ΔEp = 0.133V, while our potentiostat produced ΔEp of 0.132V, indicating minimal variations with the same PCB layout, despite using different substrates. The standard rate constant (Ks) of electron transfer can also be obtained from CV and was measured to be 0.0037 for the rigid PCB and 0.0035 for the flexible PCB.

Author Keywords
Biosensing applications; Cyclic voltammetry; Flexible printed circuit board; FPCBs; Potentiostat

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