A Portable Electrochemical Measurement Platform for Wearable-Flexible Sweat Sensors

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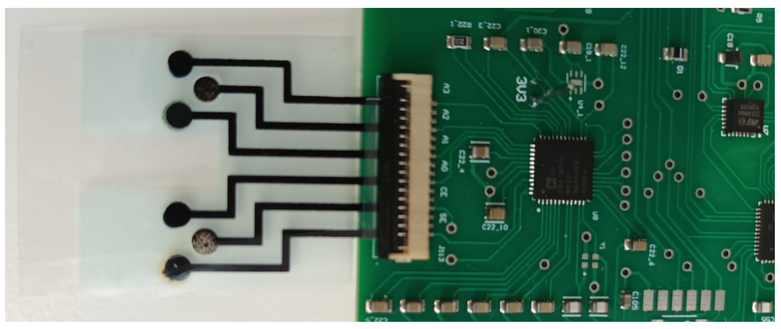
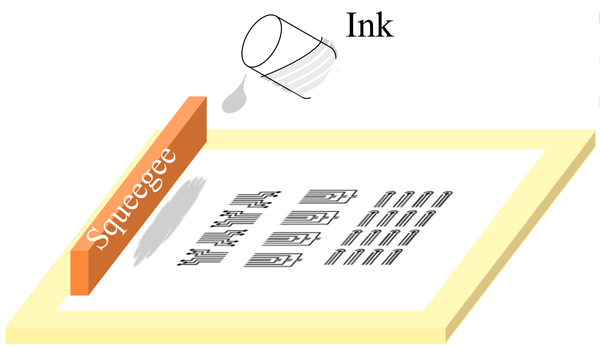
1. Introduction

- Wearable sweat sensors: non-invasive and continuous monitoring of biomarkers
- Our novel screen-printed sweat sensor contains: Na^+, K^+ Ion Selective Electrodes (ISEs), pH, and lactate sensing elements
- This work presents a unified, portable, and compact electrochemical measurement platform that can perform potentiometric, amperometric, and impedimetric measurements to interface different types of flexible sweat sensors



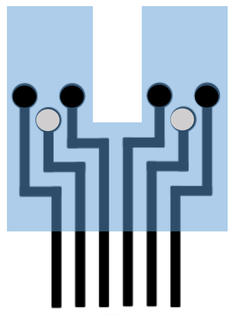
2. Sweat Sensor Fabrication

A) Screen-printed electrode arrays



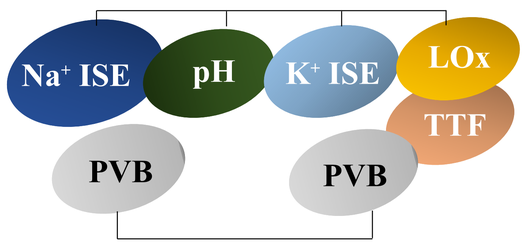
Frame and Mesh

Carbon
Ag/AgCl
Dielectric



B) Drop casting sensing membrane

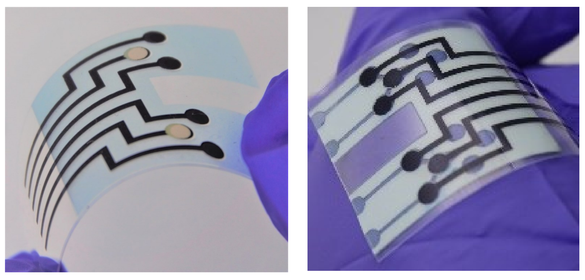
On Working Electrodes



Reference Electrodes

- Carbon Working Electrodes (WE)
- Ag/AgCl Reference Electrodes (RE) on carbon Counter Electrodes (CE)

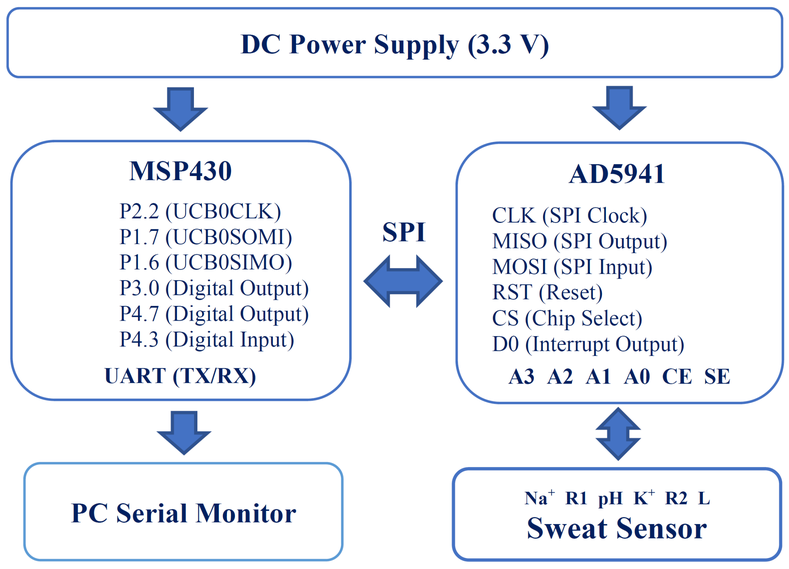
C) Sensor assembling



Laser-cut microfluidic channels with inlets and adhesives assembled on the flexible electrode array.

3. Measurement Electronics

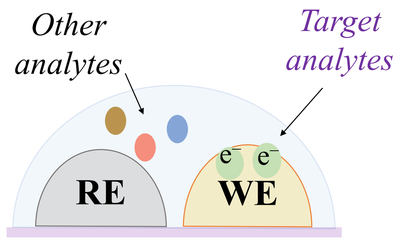
Our measurement device is based on the Electrochemical Front End (EFE) **AD5940** (Analog Devices) controlled by a low-power microcontroller **MSP430** (Texas Instruments).



It performs two types of measurements:

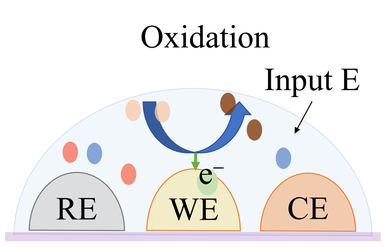
1) Open Circuit Potential

Na^+, K^+, and pH ISEs



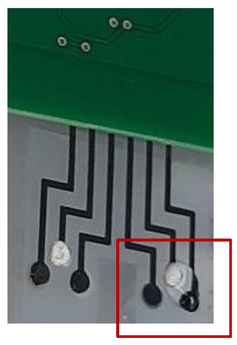
2) Amperometry

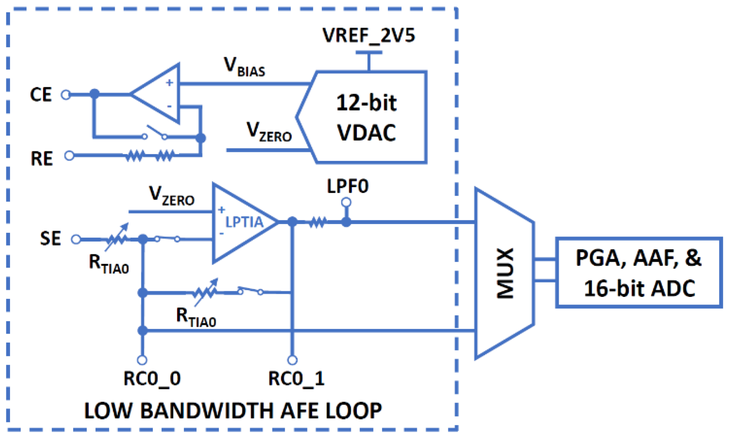
Lactate



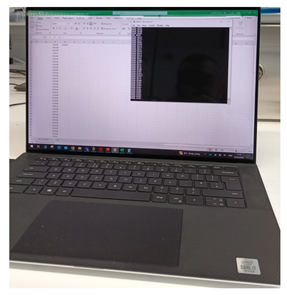
4. Experimental Evaluation – OCP

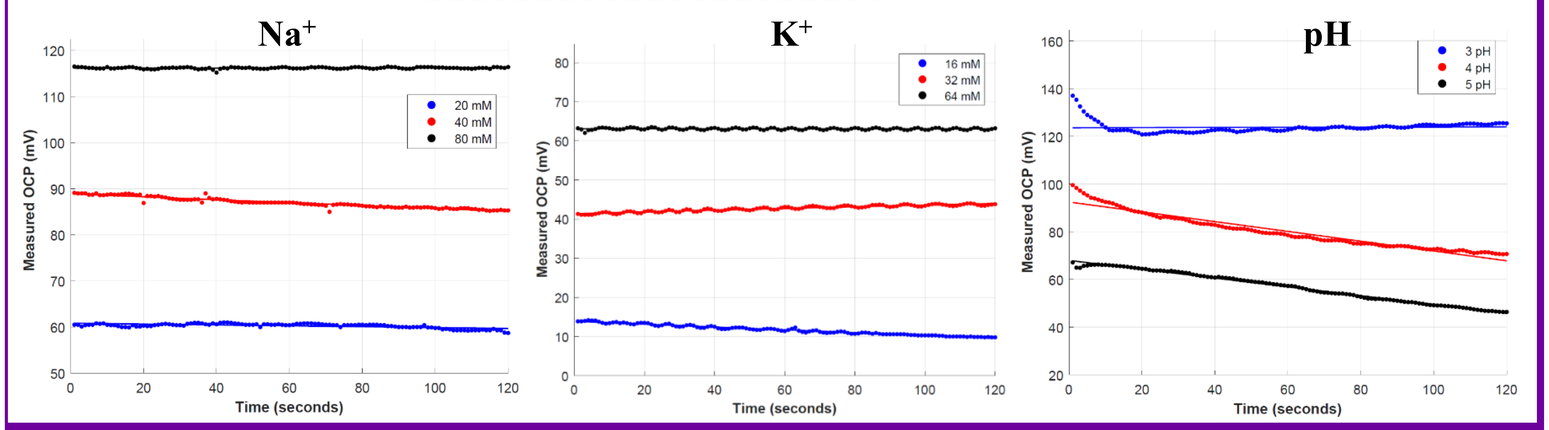
Samples dropped on sensor electrodes





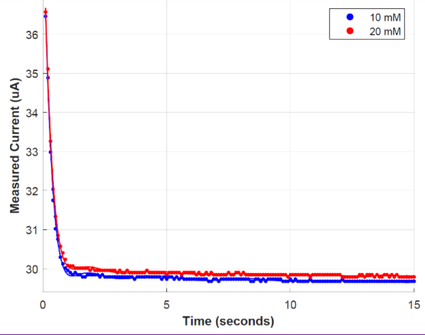
Data monitoring and processing



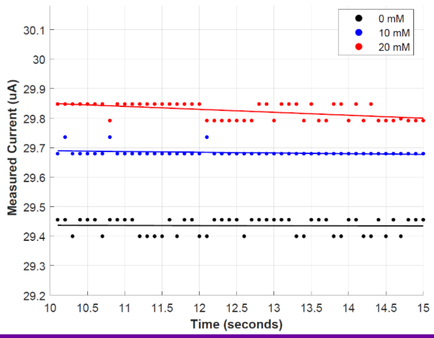


5. Experimental Evaluation – Amperometry

The measured electric current decreases with time



Different levels of electric current for different concentrations of Lactate



6. Conclusions

- The portable electrochemical sensing platform performed most electrochemical sensing methods required by wearable biosensors
- This includes amperometric, voltametric, and impedance measurements
- The experimental evaluation measured concentrations of sweat components: **Na^+**, **K^+**, **pH**, and **lactate**

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