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Portable Data Acquisition and Fluidic System for Electrochemical Sensors

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Abstract

The recent outbreak of infectious diseases has highlighted the necessity of point-of-care detection compared to central lab analysis for more effective epidemic control. Recent developments in the field of biosensors have allowed sensitive, accurate disease diagnosis using low-cost devices. In this work, we describe the development of a portable data acquisition and fluidic system for miniature electrochemical biosensors. The data acquisition system was designed as a single printed circuit board and can perform cyclic voltammetry. The fluidic chamber was designed to work with three miniature sensors which are placed on a single platform. Leakage tests were performed to ensure that each chamber allows sensor isolation and avoids any cross-contamination. Measurements using the fabricated potentiostat board were taken and compared with a commercial potentiostat. It was found that the designed potentiostat was able to measure the same resolution and peak separation in cyclic voltammetry measurements. © 2023 IEEE.

Author Keywords

biosensor; cyclic voltammetry; data acquisition system; electrochemical biosensor; fluidic chamber; Point-of-Care (PoC); potentiostat; printed circuit board

Index Keywords

Biosensors, Contamination, Cyclic voltammetry, Data acquisition, Diagnosis, Disease control, Electrochemical biosensors, Microelectrodes, Timing circuits, Voltage regulators; Data acquisition system, Electrochemical biosensor, Fluidic chamber, Fluidic systems, Infectious disease, Lab analysis, Point of care, Point-of-care, Portable data acquisition systems, Potentiostats; Printed circuit boards

References

- Chadha, U.
Recent progress and growth in biosensors technology: A critical review
(2022) *Journal of Industrial and Engineering Chemistry*, 109, pp. 21-51.
May
- Rahman, M.M.
Progress in Electrochemical Biosensing of SARS-CoV-2 Virus for COVID-19 Management
(2022) *Chemosensors*, 10 (7).
MDPI, Jul. 01
- Hegde, S.S., Bhat, B.R.
Dengue detection: Advances and challenges in diagnostic technology
(2022) *Biosens Bioelectron X*, 10, p. 100100.
May
- Singh, A.
Recent Advances in Electrochemical Biosensors: Applications, Challenges, and Future Scope
(2021) *Biosensors*, 11 (9), p. 336.
Page 336, 11, Sep. 2021
- Crapnell, R.D., Dempsey-Hibbert, N.C., Peeters, M., Tridente, A., Banks, C.E.
Molecularly imprinted polymer based electrochemical biosensors: Overcoming the challenges of detecting vital biomarkers and speeding up diagnosis

- (2020) *Talanta Open*, 2, p. 100018.
Dec
- Xie, M., Zhao, F., Zhang, Y., Xiong, Y., Han, S.
Recent advances in aptamer-based optical and electrochemical biosensors for detection of pesticides and veterinary drugs
(2022) *Food Control*, 131.
Elsevier Ltd, Jan. 01
 - Menon, S., Mathew, M.R., Sam, S., Keerthi, K., Kumar, K.G.
Recent advances and challenges in electrochemical biosensors for emerging and re-emerging infectious diseases
(2020) *Journal of Electroanalytical Chemistry*, 878.
Elsevier B.V., Dec. 01
 - Eivazzadeh-Keihan, R.
Dengue virus: A review on advances in detection and trends-from conventional methods to novel biosensors
(2019) *Microchimica Acta*, 186 (6).
Jun
 - Zainuddin, A.A.
Development of integrated electrochemical-quartz crystal microbalance biosensor arrays: Towards ultrasensitive, multiplexed and rapid point-of-care dengue detection
(2019) *Biodevices 2019-12th International Conference on Biomedical Electronics and Devices, Proceedings; Part of 12th International Joint Conference on Biomedical Engineering Systems and Technologies, Biostec 2019*, pp. 220-227.
 - Adams, S.D., Doeven, E.H., Quayle, K., Kouzani, A.Z.
MiniStat: Development and Evaluation of a Mini-Potentiostat for Electrochemical Measurements
(2019) *Ieee Access*, 7, pp. 31903-31912.
 - Cook, J.
(2020) *SIMStat: Hardware Design Considerations for Implementing a Low-Cost, Portable Potentiostat*,
 - Hoilett, O.S., Walker, J.F., Balash, B.M., Jaras, N.J., Boppana, S., Linnes, J.C.
Kickstat: A coin-sized potentiostat for highresolution electrochemical analysis
(2020) *Sensors (Switzerland)*, 20 (8).
Apr
 - Stratmann, L.
(2019) *EMStat Pico: An Electrochemical System on Module for Integration of Standard Analysis Methods with a Minimum of Development Effort*,
 - *Top 8 Flexible Circuit Advantages | Pcb Design Blog | Altium*,
accessed Dec. 05, 2022
 - Damiati, S., Schuster, B.
Electrochemical biosensors based on S-layer proteins
(2020) *Sensors (Switzerland)*, 20 (6).
Mar
 - Magar, H.S., Hassan, R.Y.A., Mulchandani, A.
Electrochemical impedance spectroscopy (Eis): Principles, construction, and biosensing applications
(2021) *Sensors*, 21 (19).
MDPI, Oct. 01

- Nielsen, A.V., Beauchamp, M.J., Nordin, G.P., Woolley, A.T. (2020) *3D Printed Microfluidics*, 13, pp. 45-65.
Jun
- Zainuddin, A.A. (2020) *Integrated Electrochemical and Mass Biosensor for Early Dengue Detection*, Accessed: Nov. 18, 2022

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