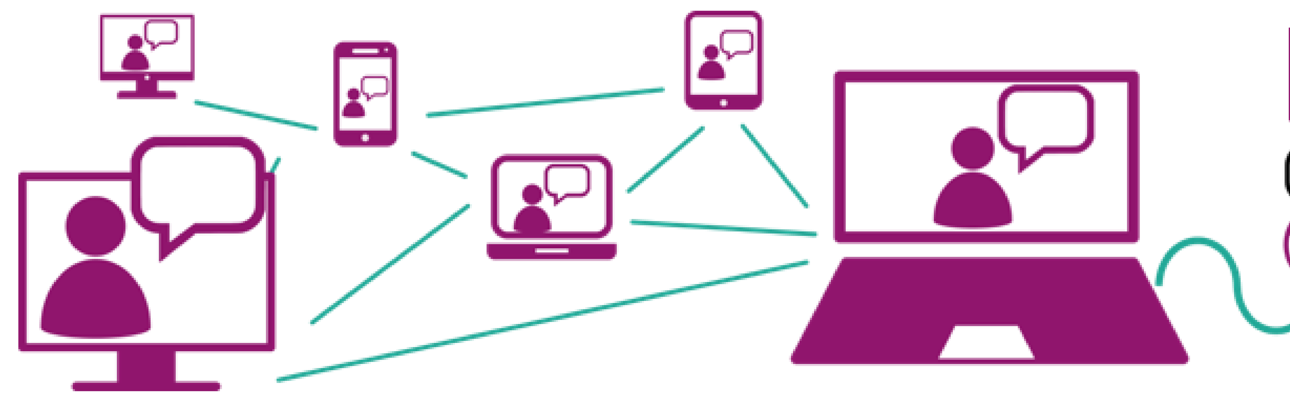


MAY 06, 2020
CONFERENCE ONLINE

BIOSENSORS FOR PANDEMICS

# Smartphone-based wireless point-of-care platform for potential electrochemical detection of SARS-CoV-2

Universidad de los Andes

Miguel Angel Aroca [a], Giulio Rosati [b], Arben Merkoçi [b] & Johann F. Osma [a]

[a] Department of Electric and Electronic Engineering, Universidad de los Andes, Bogota, Colombia

[b] Institute of Nanoscience and Nanotechnology (ICN2), Barcelona, Spain

Gobernación del Cesar

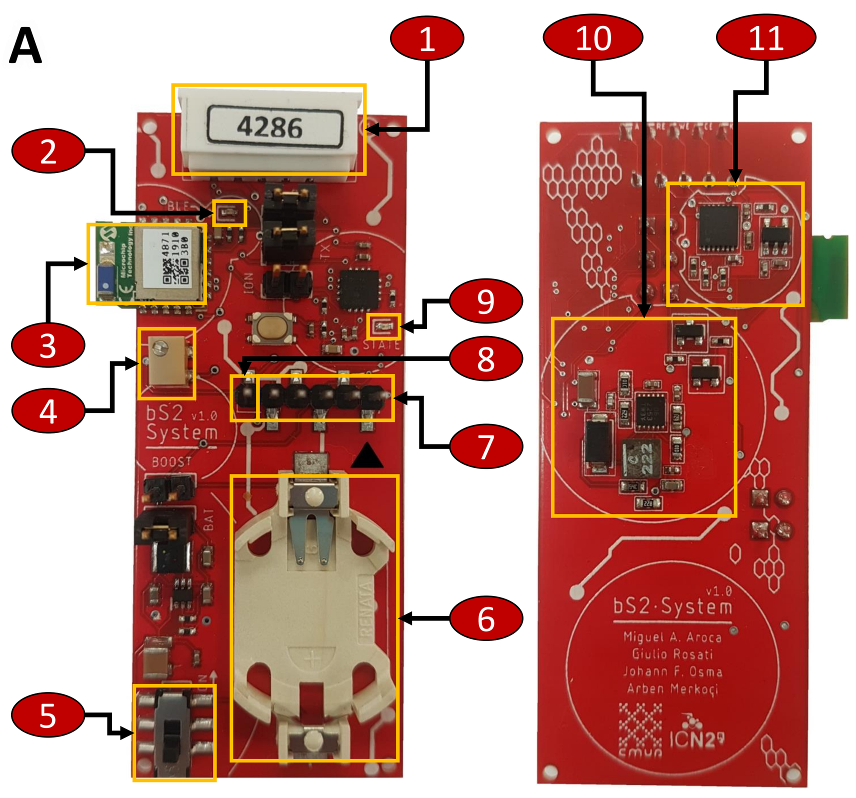
## INTRODUCTION

COVID-19 (coronavirus disease 2019), provisionally called 2019-nCoV infection and officially declared by WHO to be a pandemic on March 11, 2020, is a respiratory tract infection caused by severe acute respiratory syndrome (SARS)-CoV-2, which mainly results in pneumonia and upper/lower respiratory tract infection [1]. Cell culturing, enzyme-linked immunosorbent assay (ELISA), or reverse transcription polymerase chain reaction (RT-PCR) are some of the conventional methods used for disease diagnosis. However, according to some earlier reports, a majority of these methods require expensive reagents and equipment as well as well-trained personnel. In addition, they often have limited speed, sensitivity or specificity [2]. On the other hand, electrochemical biosensors have presented high sensitivity and selectivity real-time detection of pathogens without the requirement of additional processing steps or reagents. Nevertheless, using low energy wearable and wireless electronic devices are required for a rapid, versatile and low-cost point-of-care electroanalysis [3–5].

## METHODOLOGY

In this study, low-cost and wide energy efficiency electronic platform for a rapid and versatile electroanalysis, is shown (Fig. 1). The device of 2.9 cm × 7.0 cm is powered by a 3 V coin cell battery (Fig. 1b) and performs some of the most common electroanalytical techniques of chronoamperometry (CA), differential pulse voltammetry (DPV) and square wave voltammetry (SWV). These tests can be carried out for more than 24 uninterrupted hours.

A




**Interface Description**

1. 5-lead FFC/FPC connector.
2. Communication Status LED.
3. Bluetooth Low Energy 4.2 RF module.
4. Reverse Iontophoresis Potentiometer.
5. Power switch. Scroll up to turn on ↑.
6. Coin-cell battery support.
7. ICSP™ programming connector.
8. Pin P2_0; BLE configuration input.
9. Measurement status LED.
10. Reverse Iontophoresis module.
11. Electrochemical measurement module.

B

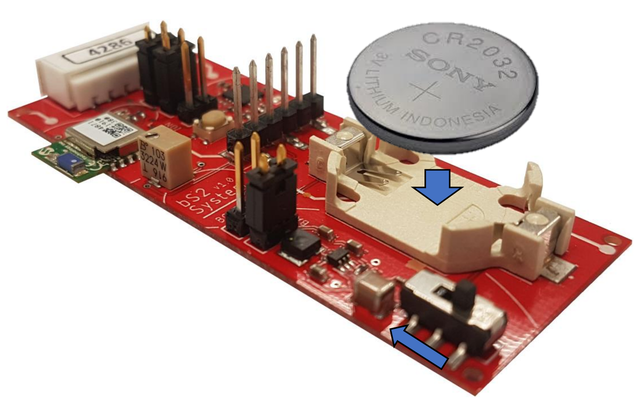


FIGURE 1: bS2-System v1.0 Board A) Interface Description B) Battery connection

Additionally, the electronic platform using "Bluetooth Low Energy" protocol for both receiving the parameters from the user and sending the test results to a smartphone where a custom app (Fig. 2) has been developed and installed. The App not only allows to visualize the results in real time but also exports them in a file .csv or .jpg for further analysis (Fig. 2d).

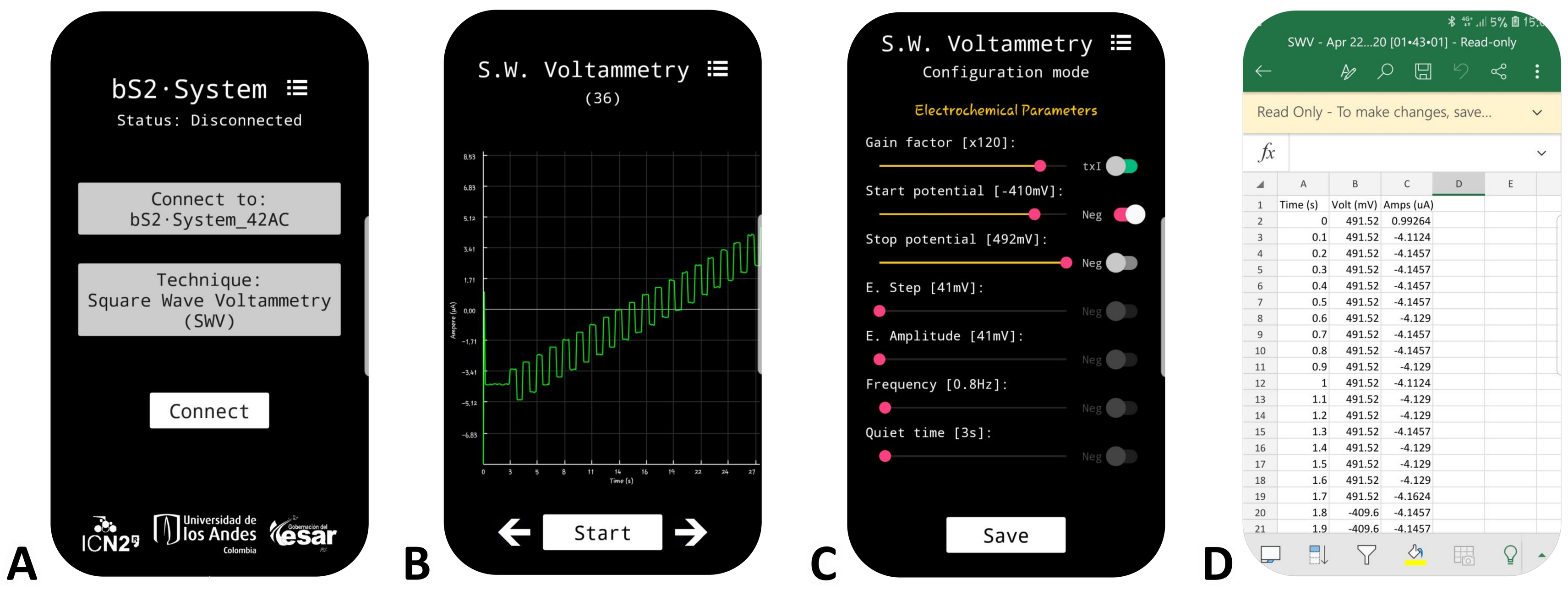



FIGURE 2: Custom app. A) Main screen. B) SWV graphical result. C) Configuration screen. D) Exported result.

## RESULTS, CONCLUSIONS AND OUTLOOK

Finally, the device has been electrically tested through precision resistance load bank. The results obtained showed two operating voltage ranges: ±720 mV with steps of 60 mV and ±492 mV with steps of 40 mV, a working current range from 5 µA to 750 µA (full scale), and an energy consumption less than 10 mW. Electrochemical tests with ferro ferricyanide at 10 mM were also done (Fig. 3).

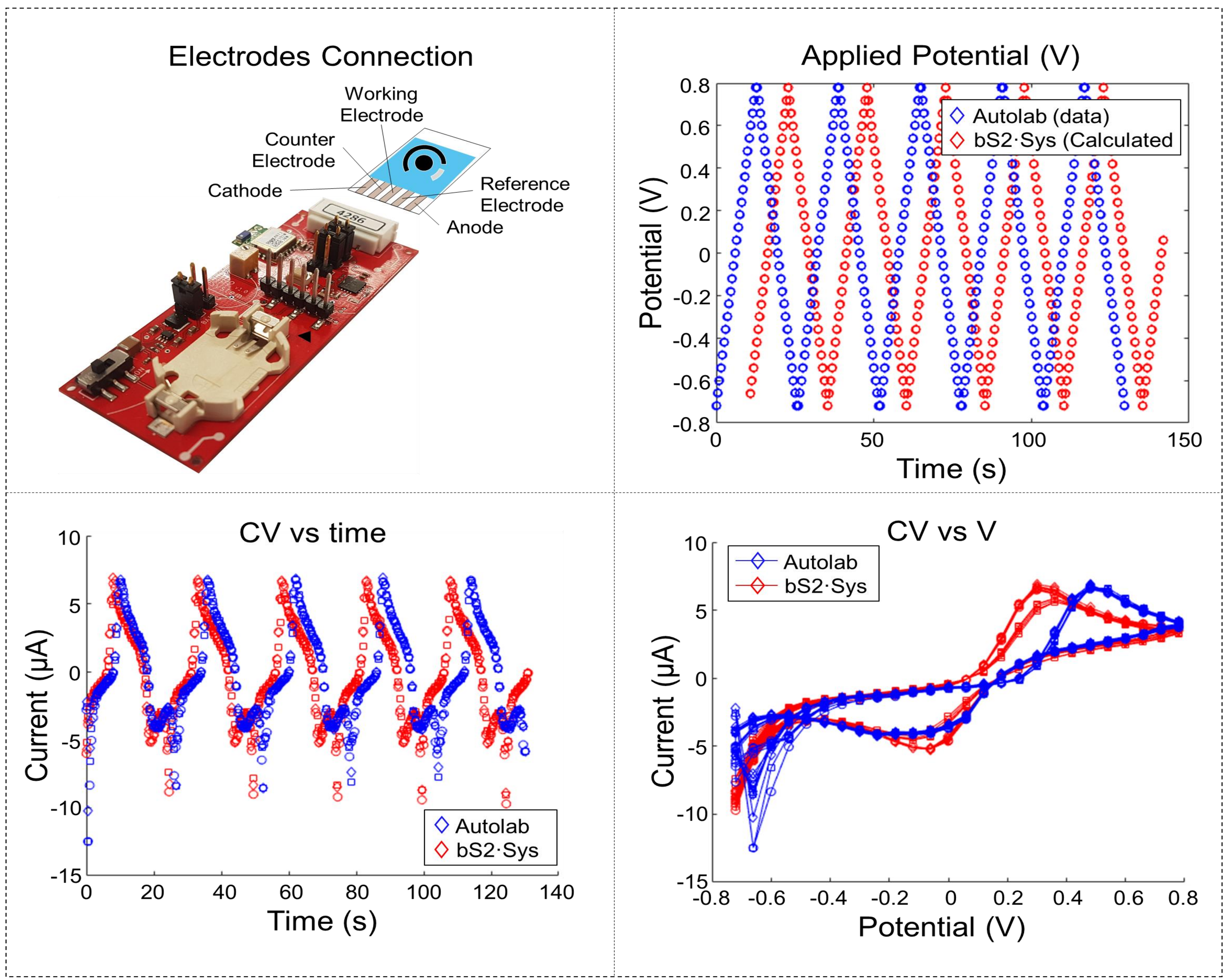



FIGURE 3: Electrochemical tests with ferro ferricyanide at 10 mM

As can be seen in Figure 3, There is a good correlation between the data generated by Autolab and the data generated by bS2System board; however, it is necessary to correct, by software, a delay in the time scale in the bs2System. Based on the work developed in [3], where a genosensor on gold films for enzymatic electrochemical detection of a SARS virus through a square wave format with frequency of 50 Hz, amplitude of 50 mV and potential between −0.15 and +0.3 V is shown, these platform may allow a rapid and versatile diagnostic (SARS)-CoV-2 if the system is coupled with a biosensor of this type that includes an appropriate gene of (SARS)-CoV-2 as target.

## CONTACT PERSON

Miguel Angel Aroca*
ma.aroca@uniandes.edu.co

Johann F. Osma
jf.osma43@uniandes.edu.co

## REFERENCES

[1] S. Jiang, C. Hillyer, and L. Du, *Trends Immunol.* (2020)
[2] H. Zhu, Z. Fohlerová, J. Pekárek, E. Basova, and P. Neužil, *Biosensors and Bioelectronics*, vol. 153. (2020) 112041
[3] A. González-López and M. T. Fernández Abedul, in *Laboratory Methods in Dynamic Electroanalysis* (2020) 213–220
[4] E. Cesewski and B. N. Johnson, *Biosens. Bioelectron.*, vol. 159 (2020) 112214
[5] J. T. C. Barragan and L. T. Kubota, *Electrochim. Acta* vol. 341 (2020) 136048

BIOSENSORS FOR PANDEMICS
MAY 06, 2020 CONFERENCE ONLINE