



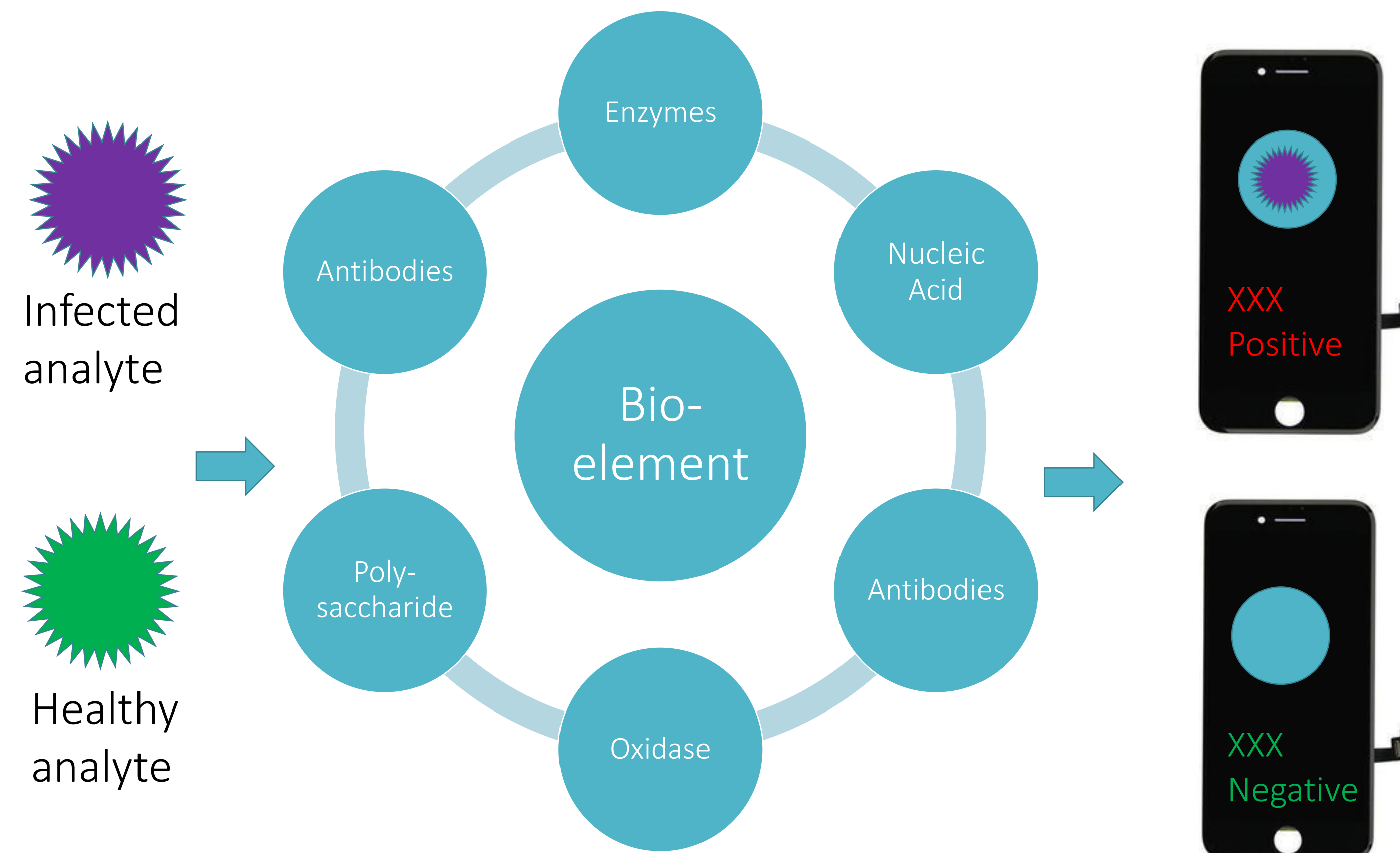
A Portable Biosensor System for Pathogen Diagnostic Applications

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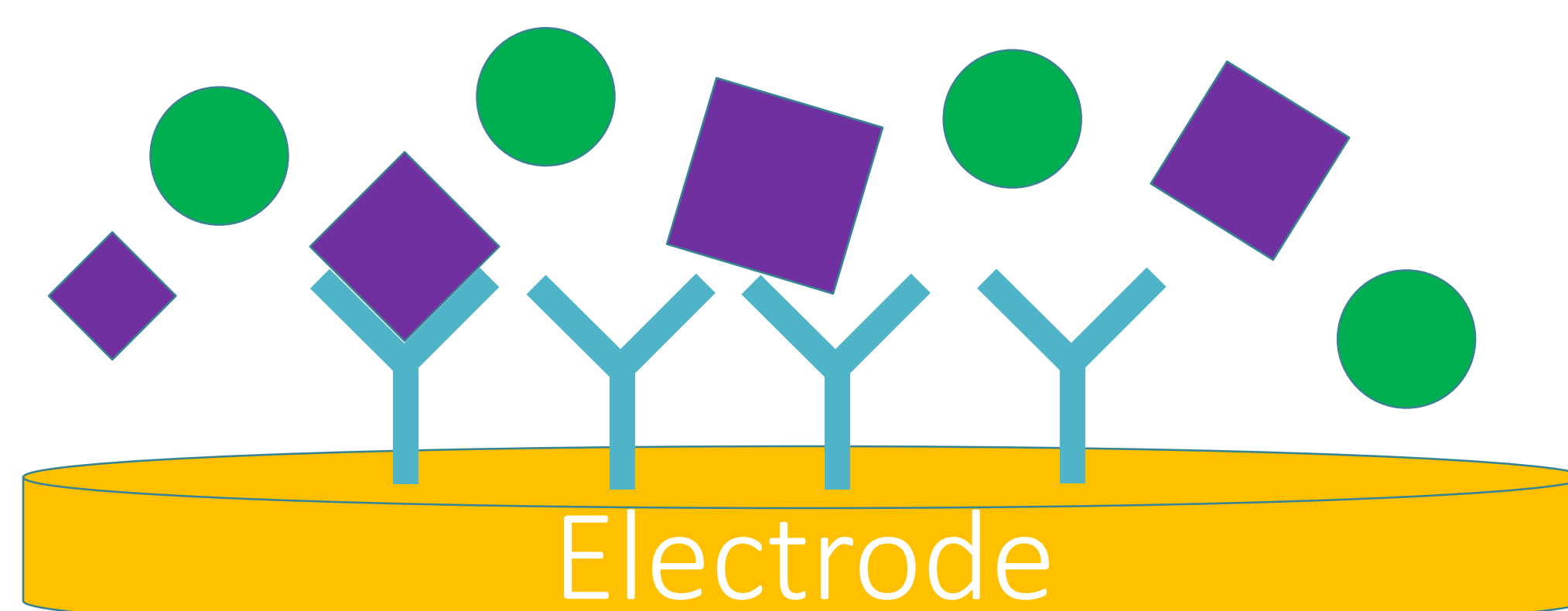
What's a biosensor

➤ **Biosensor** is a device that can introduce analyte into nowadays digital world through bio-elements, and present people a straightforward representation of their existence.



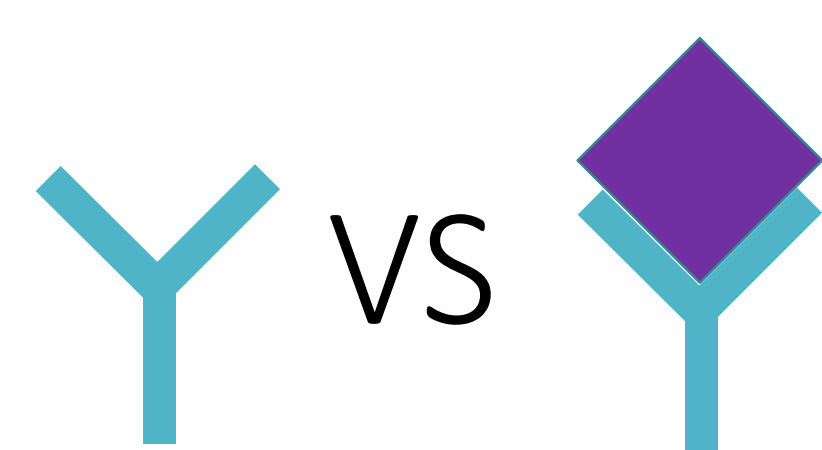
Electrochemical detection

➤ **Electrochemical method** is used as a transducer to present the signal of the analyte. Depends on the interact type, binding or recognizing, the bio-sensing interface can behave different electrical property, which can be used as the very signature for identification.

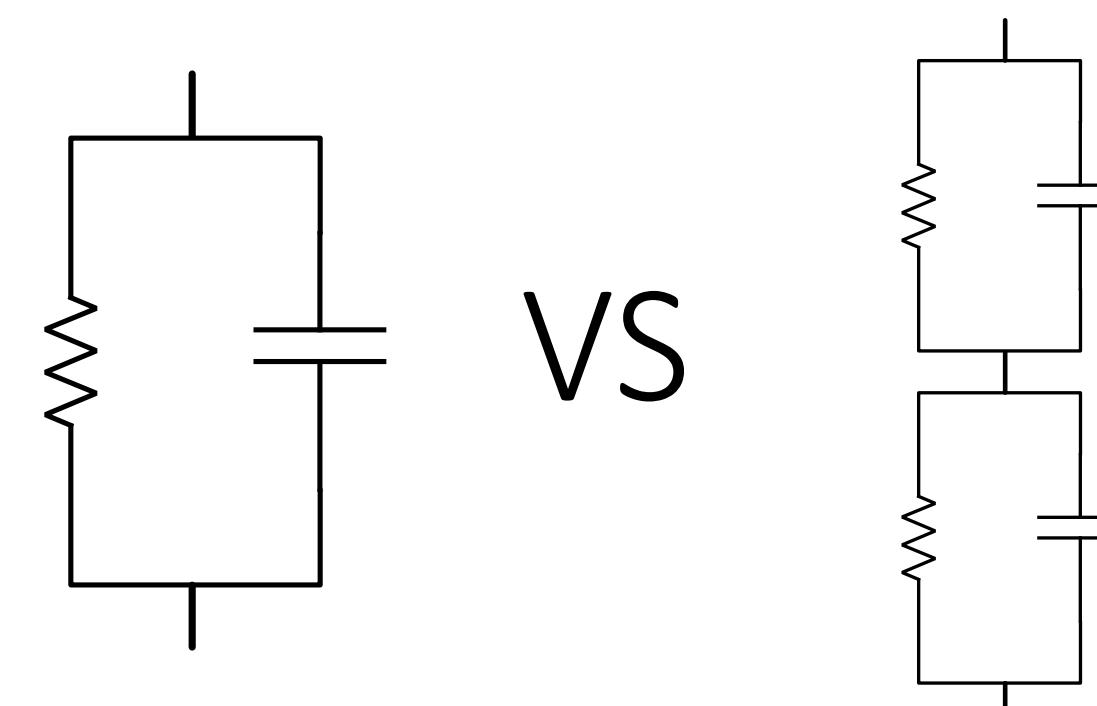


➤ **Molecule as circuit** is a concept that views all molecule have their equivalent circuit model to describe their electrical response. The circuit model is typically formed by resistors and capacitors in series or parallel.

Conceptual View



Electrical View



System Level Implementation

Specify target

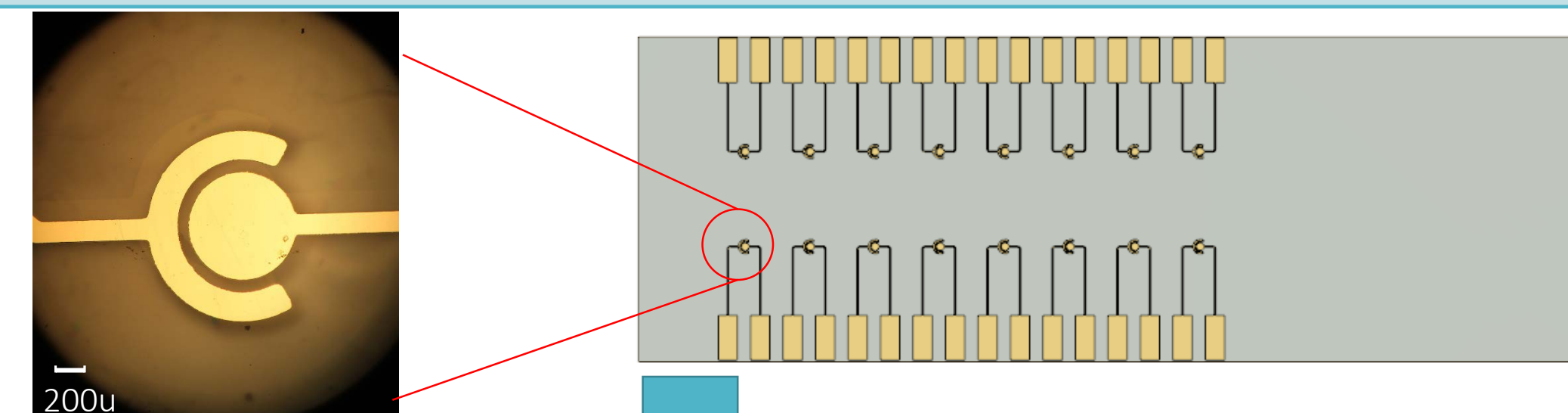
Zika, chikungunya, HIV...

Choose Bio-element and protocol

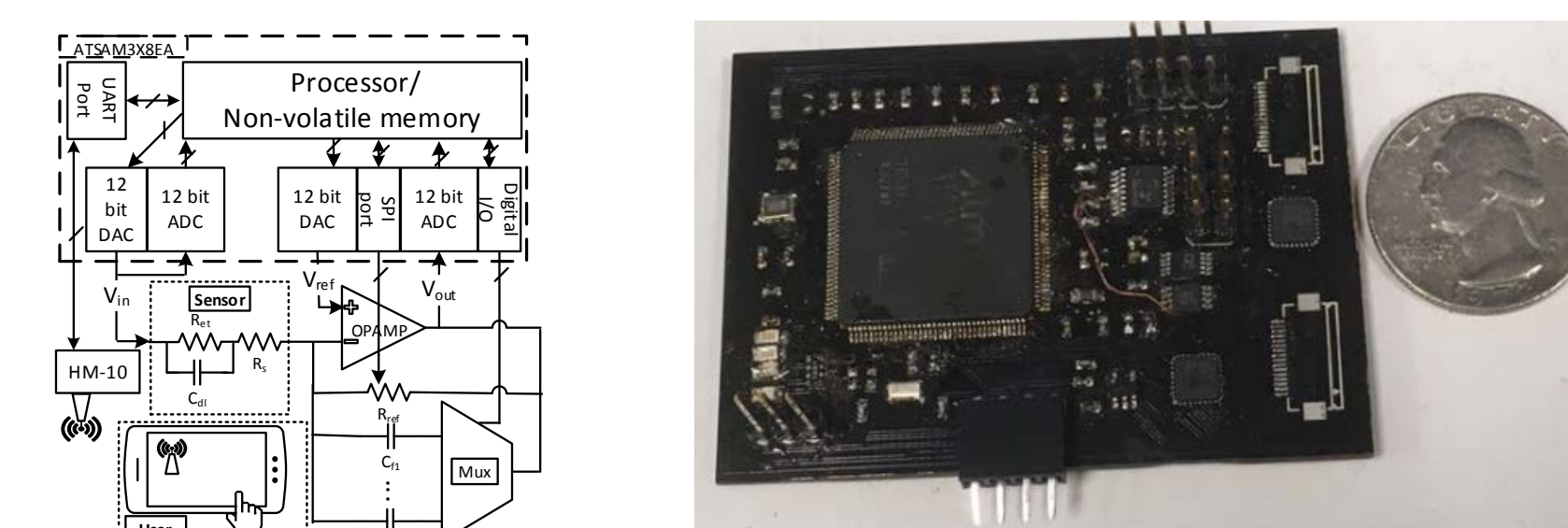
Specific antibody, complementary DNA...

Design electrode

Electrode type, geometry, manufacturing...



Design electronics



Data process and transmission

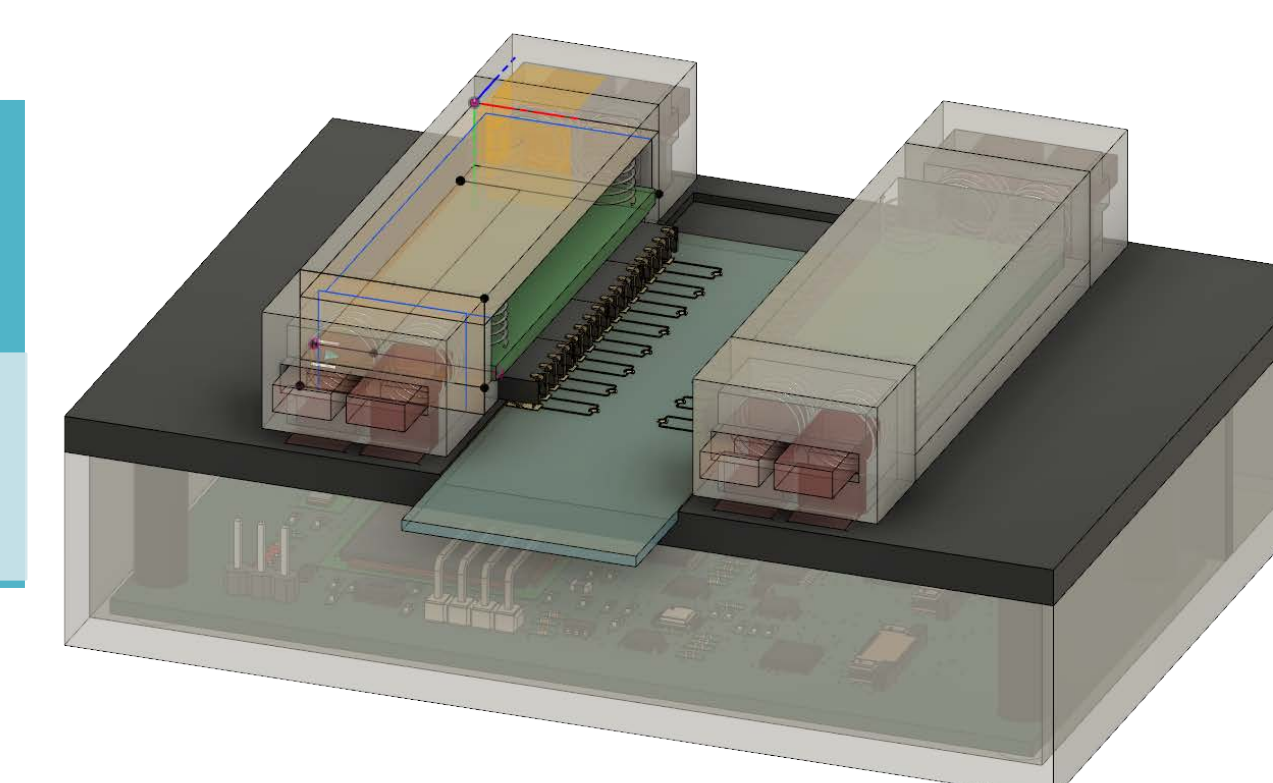
Process analog signal to data Wired or not wired (Wifi, BT)

Design User interface

Decide user's terminal device (PDA, cellphone, standalone display)

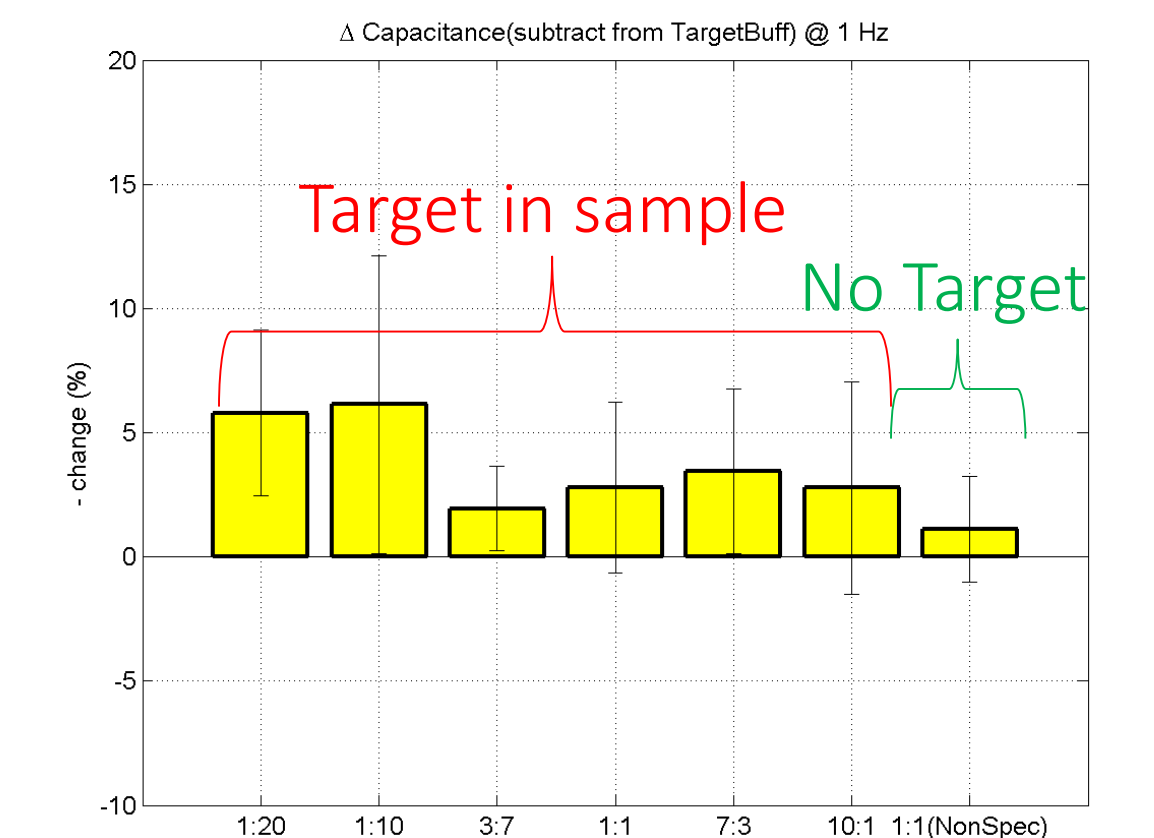
Deliverable Package

3D Printing or molded manufacturing



Project Overview

➤ **Zika protein** were used as target, the preliminary data from commercial instrument showed the response from target protein is stronger than non-specific ones when binding with probe antibody.



➤ **Whole system** is illustrated as below. It can be power by a rechargeable battery. The prototype case was printed by 3D printer. An app was developed on android system to allow user to receive real time data measured from the biosensor through Bluetooth 4.0.

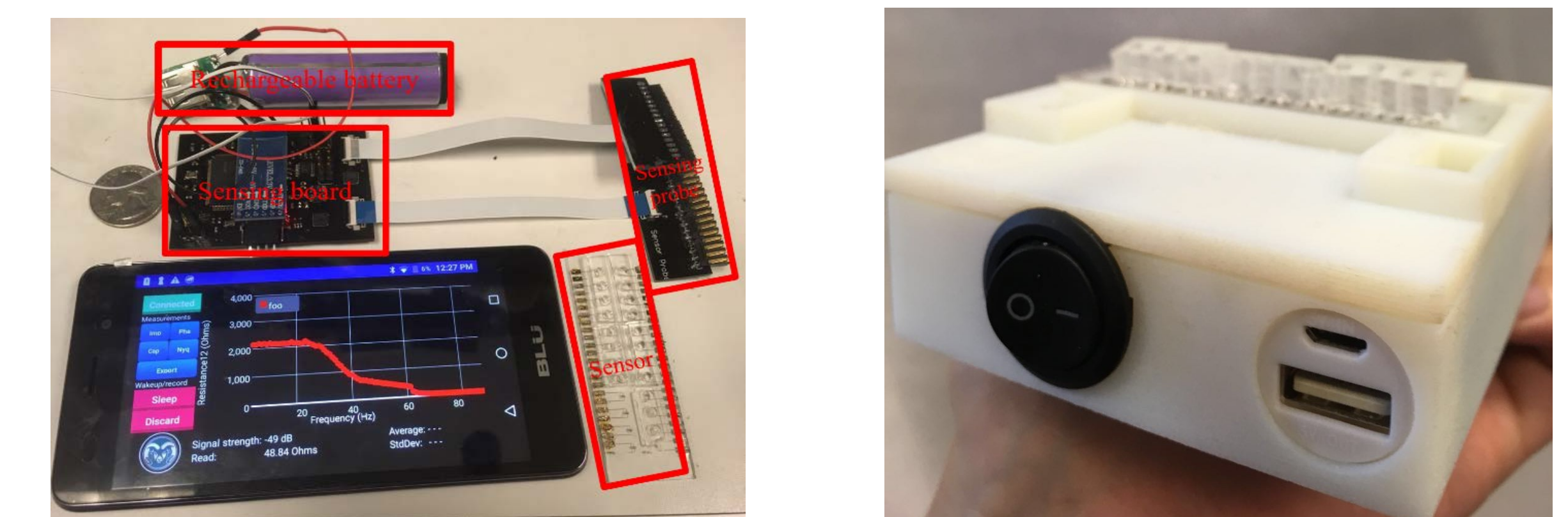


Figure 1. (a) System components. (b) 3D Printed case.

➤ **Electronics were tested** by both dummy RC model and chemicals can generate reduction-oxidization current (Redox couple, $\text{Fe}(\text{CN})_3^{3-}/4^-$). The data are presented in Bode and Nyquist plot in comparison with commercial benchtop.

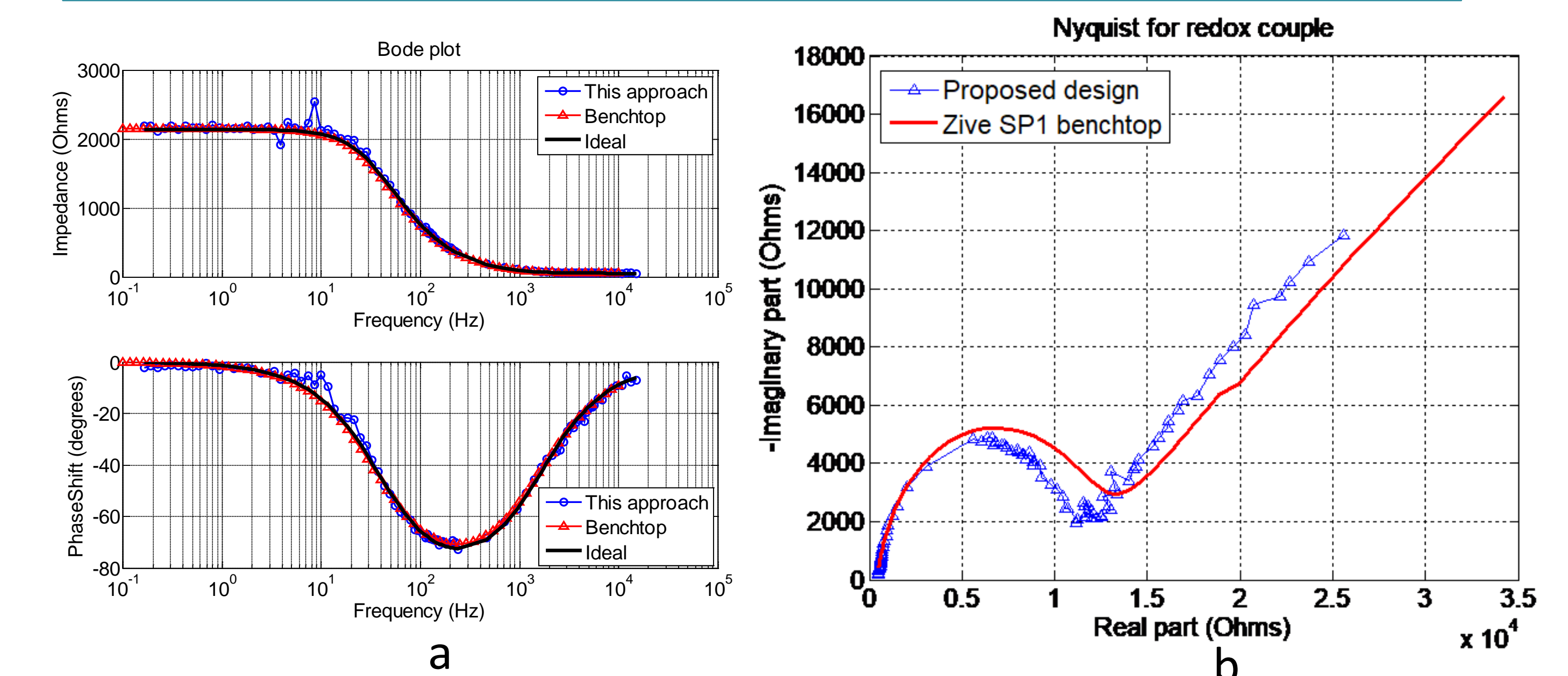


Figure 2. (a) Dummy circuit measurements in Bode plot. (b) Redox measurements in Nyquist plot.

Conclusions and future work

- A biosensor platform was designed and tested. The resulting errors were reasonably good impedance/capacitance measurements.
- Future work lies in the test of actual virus/bacteria/protein/DNA.
- The platform will be further tested to do 4 electrode system and gets ready for other electrochemistry detection approaches, such as CV, DPV and potentiometry/ampereometry.

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