Electrochemical Impedance Spectroscopy Meets Arduino: Can We Make an Open-source Impedance Analyzer?

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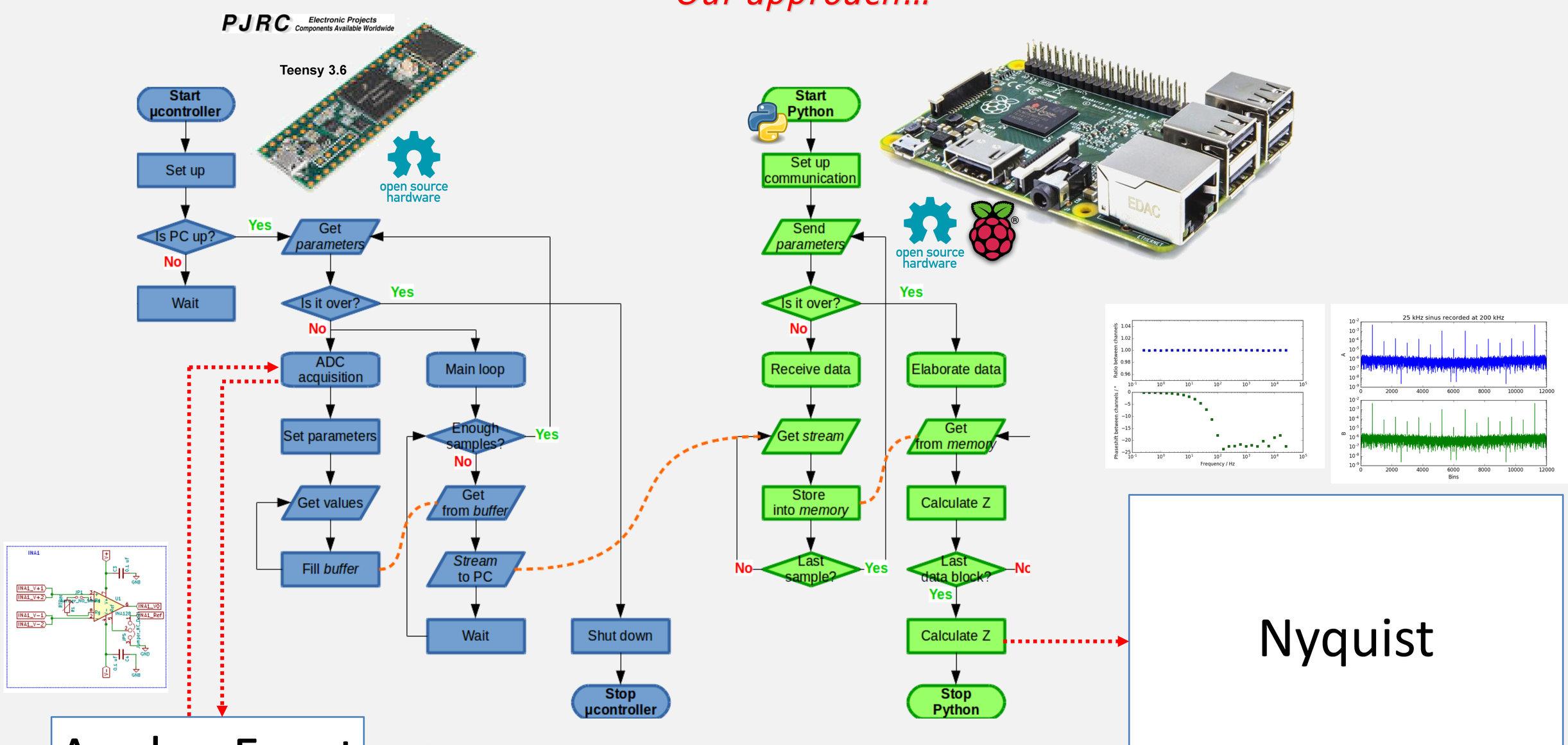
Introduction

Commercial potentiostats which offer modules to perform electrochemical impedance spectroscopy (EIS) have very high specifications like broad frequency range (> 6 orders of magnitude), high accuracy, and low distortion. However, they are much more expensive than standard instruments. Moreover, the instrument is a black box where the scientist often has little or no knowledge of the real operations (e.g. automatic phase corrections or current range selection), or some finer features are hidden in the software (e.g. the choice of an arbitrary integration time or inspection of harmonic distortions). Although the hardware is very high quality, these limitations hinder more sophisticated applications, or simply make troubleshooting more complicated. To address these limitations and improve access to impedance techniques, we set out to develop an open-source impedance analyzer.

Our approach…



Conclusions

- **Yes, we can!**
- We constructed an impedance analyzer from open source hardware (core Teensy 3.6 PJRC microcontroller) which works up to 50-100 kHz.
- The waveform can be arbitrarily chosen, between single sinus to complex multisine containing more than 100'000 points.
- It is portable and compatible with PC (Windows, Linux, MacOS) and Raspberry PI.
- All the code, schematics, and illustrations are available online on a GitHub repository.
- This open source impedance analyzer is also cheap (less than 200 €).