An Open Potentiostat

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Potentiostats are commonly used to test for the presence (via electrical activity) of particular compounds and microbes in solution, and thus have applications in environmental monitoring, food and drug testing, and many other areas. Typically, potentiostats are used in a research or industrial laboratory context for these purposes, and most commercially-available potentiostats are very expensive ($1000 is on the “cheap” side). There have been several initiatives in the last decade that have focused on designing cheaper alternatives; and when investigating technologies related to water quality assessment. Our aim here is to build on these efforts, and leverage the experise of the open hardware community in order to build a very accessible, and capable, device. Possible applications include:

- **Tracking heavy metal concentrations in waterways.** Various industrial processes used in the US and abroad can lead to the contamination of water with heavy metals that are dangerous to humans, like mercury and arsenic. An inexpensive, battery-powered potentiostat -- communicating over the cellular network, perhaps, or merely recording locally to an SD card -- might be able to track relative fluctuations in the concentrations of these metals, making monitoring these contaminants easier.

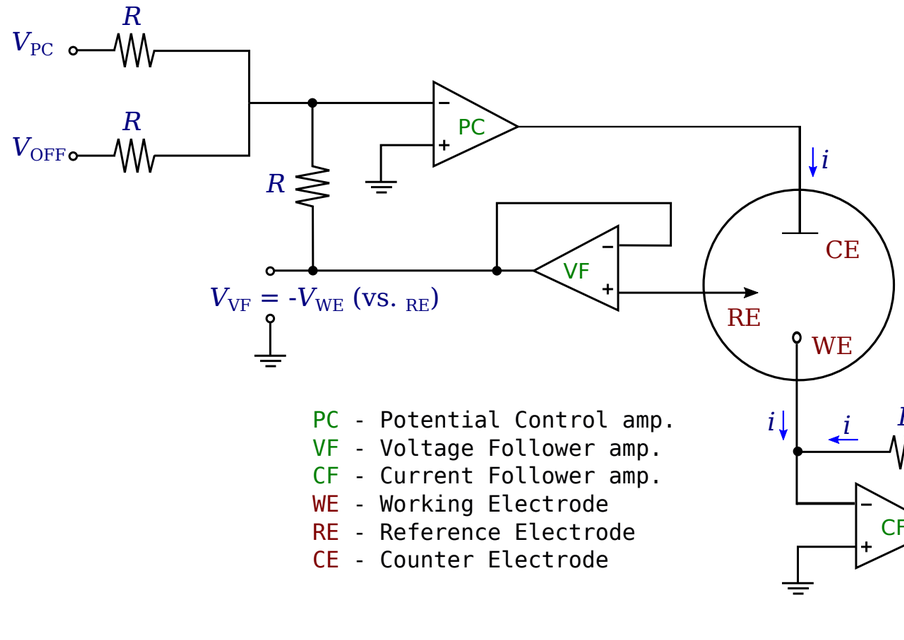
- **A low-cost ‘field lab’ for evaluating water samples.** An inexpensive potentiostat, when used according to the proper protocols, might be used to indicate absolute concentrations of heavy metals in water. This could allow citizens and organizations who can’t afford to send water samples to an expensive, bonded laboratory to do their own testing -- particularly relevant in a developing-world context.

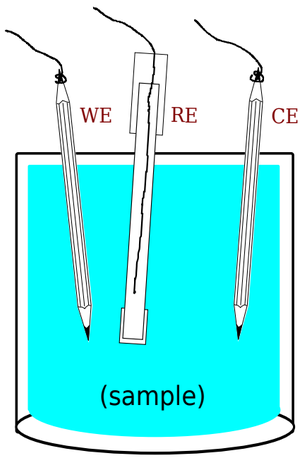
- **Education.** Electrochemistry is an important part of many high school, college, and graduate chemistry curricula; an inexpensive potentiostat could render these curricula more accessible to educational institutions that don’t have the budget for the more expensive commercial versions.

- **Research.** Making an easily-hackable, programmable, and extensible potentiostat platform, based on a widely-used and well-supported technologies like the **Arduino** and the **Raspberry Pi**, could allow for novel electrochemistry applications in the laboratory; when a device that once cost $2000 and didn’t “play nice” with other hardware and software suddenly becomes available for under $200, and can be integrated with easy-to-use, open source software and hardware, researchers will likely dream up new approaches to open research problems -- and higher-throughput approaches in already-established research areas.

The Circuit: an Adder Potentiostat

Ref.: Bard, Allen J., and Faulkner, Larry R. *Chap. 15: Electrochemical Instrumentation*. **Electrochemical Methods: Fundamentals and Applications**, 2nd ed. John Wiley & Sons, Inc., 2001. pp. 632-658





References:

CheapStat: http://bit.ly/162rg4G
Cornell U Potentiostat: http://bit.ly/17HBgyI
PVOS Potentiostat Software on Github: http://bit.ly/15GQcKw
Public Lab Potentiostat Wiki: http://publiclab.org/wiki/potentiostat

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Collaborations welcome!