

Development of a low-cost active water sampler for in-situ solid phase extraction

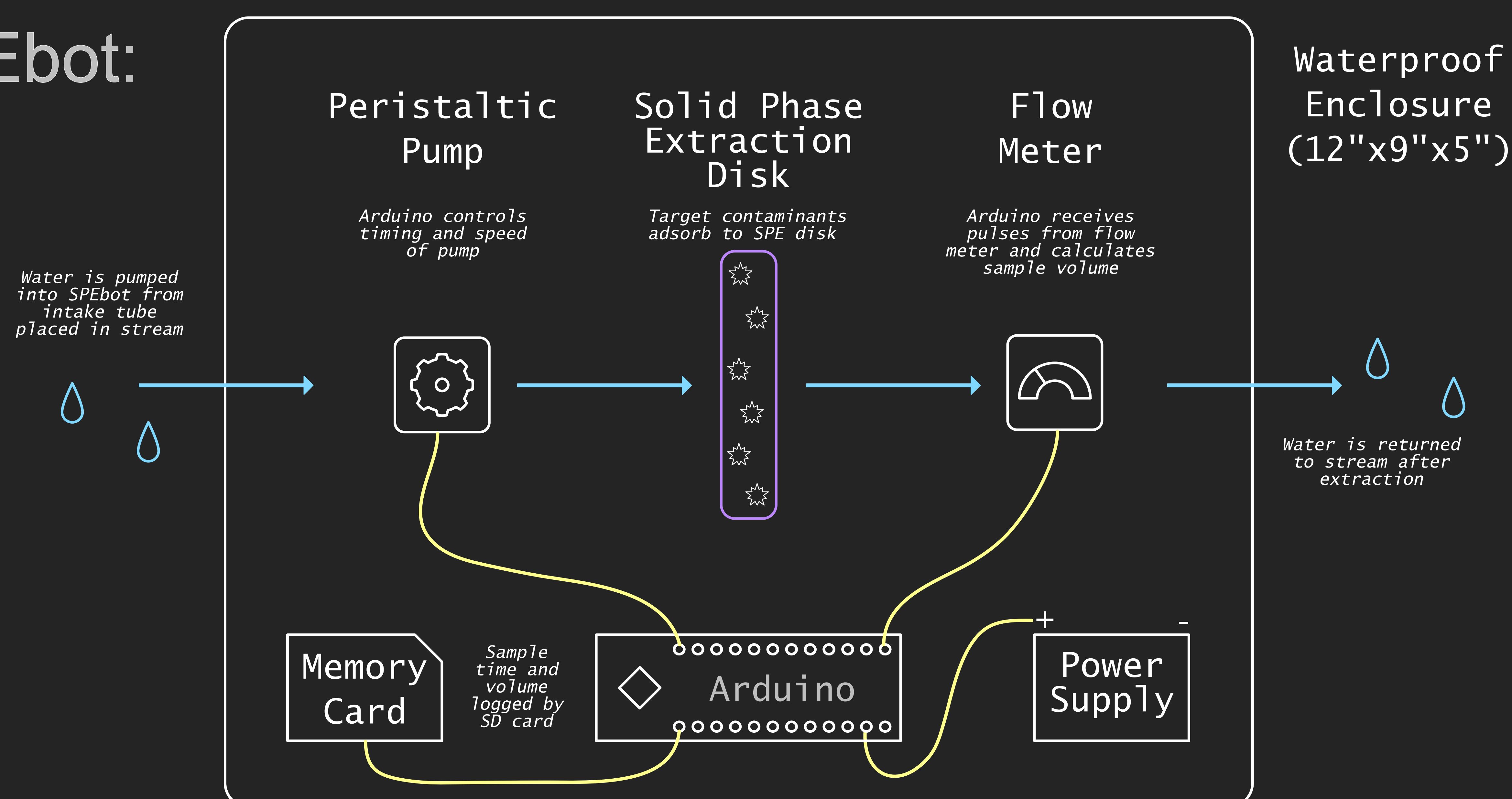
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Autonomous sampling, water quality, pesticides, contaminants, arduino

The USGS Pesticide Fate Research Group is developing an autonomous water sampler that will allow for the measurement of contaminant concentrations over time similar to other active samplers, but at a cost typical of passive samplers. The prototype device, nicknamed SPEbot (Solid Phase Extraction robot), pumps in water from the environment, through a 47-mm solid phase extraction (SPE) disk, then measures the sample volume with a flow meter placed after the SPE disk. The device is controlled with an Arduino microcontroller and the parts cost about \$400.

SPEbot:



Status

- Current device can collect 2 SPE disks at a time
- Batteries last days to weeks depending on sample frequency
- We prototyped and field tested a SPEbot configured with 2 SPE disks (HLB and SDB-RPS) and analyzed the disks for pesticides using GC-MS and LC-MS/MS
- Deployed for 3 days on the Fourteen Mile Slough in Stockton, CA in September 2019 with ~ 6 liters pumped through each disk
- Results:

Disk	Sample volume (liters)	3,4-DCA	Chlorantraniliprole	DCPMU	Dithiopyr	Fluopyram	Fluridone	Hexazinone	Imidacloprid	Methoxyfenozide	Pendimethalin	Propiconazole	Trifluralin
HLB	5.6	2.8	0.7	0.6	0.1	3.2	39.0	3.2	1.5	1.0	nd	0.8	0.6
SDB-RPS	5.8	5.0	0.8	0.5	0.8	3.0	36.3	3.0	1.2	1.1	1.9	0.7	3.0

Future Plans

- Work on pre-filtering to avoid clogs from suspended sediment or submerged aquatic vegetation
- Incorporate a float switch to do flow-triggered sampling
- Test at additional sites in Bay-Delta
- Finalize design, then release build plans and source code
- Our lab has the capability to deploy and analyze SPEbot for pesticides, but there are SPE disks that target other contaminants.
- With assistance SPEbot can be set up to target algal toxins, PAHs, PCBs, or pharmaceuticals