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# Development of a low-cost wireless controller for flexible sampling strategies based on real-time flow monitoring

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Even if models are able to predict more and more accurately pollutant discharge in streams, surface water sampling remains a very common practice to monitor substance concentrations and loads in streams and to calibrate models. However, as this method is temporally and spatially punctual, monitoring a whole catchment requires multiple sampling sites with time-distributed samples. Instruments are expensive, and sample collection, on-site interventions and maintenance are costly and time-consuming, in particular if the experimental site is remote. Another issue is the estimation of the discharge loads of a pollutant, especially for non-chemostatic compounds; their hydrograph-related chemical dynamics may be miss-evaluated when a rapid storm occurs using a time-paced sampling strategy with large sampling intervals. Many manufacturers provide discharge gauges (pressure probes or ultra-sonic sensors) or other instruments (rain gauge, chemical probes, etc.) that can be coupled with automatic water samplers in order to program an event-paced sampling. However, automatic samplers usually provide limited programming options that may not meet the needs of the experimenter of a specific catchment. The concept presented here proposes to use a simple microcontroller board in order to determine the timing of the samples by sending electrical pulses to a conventional automatic sampler with input capability. The flow level is measured by a low-cost ultrasonic sensor and sent to the microcontroller, which will process the signal according to user and site-custom parameters. For example, a simple power-law recession model can be apply to approximate the duration of the recession period given the maximal discharge rate measured for a storm. The sample intervals can thereafter be set in order to distribute all the bottles available over the total recession duration. The microcontroller sends a pulse (grab sample query) to the sampler at every sample time calculated by the program. A GSM/GPRS shield coupled with the microcontroller allows the data upload (flow rates, sample time, state, number of bottles available, etc.) on a web-server and can inform the experimenter by SMS about the beginning of a sampling event, a water level alert or a technical issue. This technique provides a low-cost and very flexible solution for designing advanced sampling schemes.