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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Open-source Arduino-derived data loggers designed for field research" *by* Andrew D. Wickert et al.

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We thank Dr. ir. Hut for his multiple constructive comments on our manuscript. We plan to make multiple changes and improvements in response to his comments. We note these changes in the responses to his enumerated points (below; original text not repeated):

1. Telemetry is increasingly included in field data-logging systems, so this is a fair and important point. We plan to add the following text to a revised manuscript [see Discussions paper for bibliographic entries]:

- "(i.e., no built-in telemetry)" – after "standalone units"

- After the paragraph on power consumption, we have added this paragraph: "As a result of our desire to minimize power consumption, which is especially important for field deployments in remote regions, we decided not to include on-board telemetry. Off-board radio (e.g., RFM95, XBee), mobile phone (e.g., Particle Electron, Particle Boron), or satellite (SPOT, Iridium) telemetry packages could be added through the exposed digital interfaces on the ALog data logger. However, such additions would require their own significant power paths, including rechargeable batteries, charge controllers, and solar panels, thus negating much of the low-power benefit of the ALog BottleLogger design. Other designs – including the MayFly data logger (Hicks et al., 2015), which includes an XBee header and firmware support for radio telemetry (Aufdenkampe et al., 2017), and direct logging by Adafruit Feather or Particle internet-of-Things ("IoT") boards, so long as data can be telemetered and timestamped rapidly enough that the lack of an accurate on-board real-time clock is not a problem – are good options where data return and not power consumption is the variable to optimize."

2. We will add a new subsection on "Enclosures" inside the "Field deployment" section. We plan for its text to read:

"Choosing an appropriate enclosure is a key decision for equipment survival in the field. The "BottleLogger" moniker comes from its designed form factor that allows it to fit inside a wide-mouth Nalgene bottle. Such bottles seal well and are commonly available from suppliers of both laboratory and outdoor equipment. This design feature was created as an option when easier-to-use but harder-to-souce enclosures are not available. In the majority of our deployments, we have used ABS NEMA (i.e., outdoor-rated) enclosures (models NBF-32104 and NBF-32108). These boxes are gasketed, include lever-style clips for easy opening and closing in the field, are large enough for either 3×D or 3×AA cells, and may be easily drilled or machined to accommodate cable glands for connections to sensors. The shorter enclosure (NBF-32104) requires

a right-angle barrel jack plug in order to fit the length of the logger, SD card, and power connector into the box.

We typically attach the loggers to the lid of the enclosure and the battery pack to the bottom of the enclosure using self-adhesive hook-and-loop. This holds both in place, but allows either to be easily removed for wiring. The longer boxes (NBF-32108) permit cable glands to be drilled in the lid next to the logger, reducing the need for cable strain-relief. The shorter boxes (NBF-32104) may include cable glands in one or more sides, if fitted with a $3\times$AA cell pack."

3a. Releases on GitHub for all relevant repositories were made prior to release.

3b. These releases were indexed on Zenodo prior to publication and are available in the "Assets" tab on the article page. However, I realize from Dr. ir. Hut's comments that I have neglected to include them in the main text. As EGU journals now require this (as is sensible), We will add references for all seven hardware, firmware, and software assets and cite them at appropriate places throughout the article.

4. This is a good point, and I will go farther to note that we did not explicitly describe interval-based logging (using the RTC) in any real detail. To remedy this, we will add the following text after the paragraph that begins "The sensors component includes...":

"Sensors may be read on a standard interval or in response to an event. When reading measurements at a standard interval (typically 1–10 minutes), the RTC wakes the ALog using an interrupt. Once awake, the ALog retrieves data from all sensors recording environmental states. Reading and recording data from these sensors typically takes 1–3 seconds, during which the ALog is operating in its high-power "awake" state (Table **??**). An event-based impulse, such as that from a tipping-bucket rain gauge, instantaneously wakes the ALog and records a time stamp to a different data file from that which is used for regular RTC-driven measurements. Reading and recording this

time stamp typically requires $<$0.3 s of awake-state power consumption. If the ALog is already awake (e.g., during RTC-driven data logging) when an event occurs, the ALog firmware records the time of the event to its file and then continues the remainder of its ongoing task."

5. Not having a clear cost breakdown is a major omission on our part! We have updated our bills of materials and will add in a table in which we specify components, PCB, and labor costs for different quantities.

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