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Geoscientific Instrumentation Methods and Data Systems Discussions

Interactive comment on "Low power GPS drifters with local storage and GSM modem made from off the shelf components" *by* Rolf Hut et al.

Anonymous Referee #2

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The authors present instructions for constructing a low-power GPS drifter with both local data storage and GSM-based data submission to a server. This is an interesting research topic as it can help provide more detailed description of river hydrodynamics over long river reaches, using Lagrangian approach. I believe that this paper is within the scope of the journal.

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General comments:

The authors provide an enthusiastic description of their approach, with a sufficiently detailed recipe for recreating their drifter design. However, two things have bothered me greatly while reading the manuscript:

1. Construction of a low-cost drifter with of-the-shelf components is not a novel idea. It has been done a good number of times before, especially in marine research (Johnson at al., 2003; Austin and Atkinson, 2004; Sabet and Barani, 2011). Additionally, some articles already offer VERY similar design ideas (Lockrigde et al., 2016; Cadena, Vera and Moreira, 2018). It is very concerning that such similar concepts were not acknowledged in this manuscript. Certain existing approaches describe similarly priced drifters, while also providing tracking of additional parameters – temperature, conductivity, etc. This indicates insufficient literature review prior to the research itself.

2. The amount of scientific novelty in the manuscript appears to be relatively low, considering the state-of-the-art. The manuscript only offers somewhat different technical solution for the drifter design and a server front/backend, which, by itself, does not merit an original research article. A good article should present the current knowledge on the subject at hand, as well as its limitations, and then clearly state how it aims to expand it and why. I feel that this was not done adequately in this version of the manuscript. One way to solve this issue would be to review the Introduction section to include additional relevant research, to discuss the strengths and weaknesses of different approaches, and then aim to overcome limitations or to improve specific aspects of said research. In order to deliver sufficient scientific novelty, instead of a single design (Particle), authors could perform a detailed comparison of several different designs: Particle-based, Arduino and Arduino-compatible boards, and some commercial/proprietary GPS trackers. This comparison could cover different performance aspects such as accuracy, reliability, battery life, etc. Such review would enable the reader to understand pros and cons of different solutions and choose the one that suits him best This way, the manuscript itself would boast considerably more scientific "weight". In the current form the manuscript would perhaps be a better fit for a "Technical note" article which is available in some journals. This is also supported by the relatively short length of the manuscript.

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Specific comments:

1. Abstract does not appear to contain all relevant information about the manuscript. A well-designed abstract should be able to present the following: (1) the description of the problem at hand, (2) an explanation on the motivation for solving that specific problem, (3) present an original method for solving that problem, (4) present some of the results and (5) implications of the research. Points (1), (2) and (5) are relatively evident in the current version, but I feel that points (3) and (4) are insufficiently covered. It would be good to explain how the authors' approach is different/better than previous methods. What will this approach enable in the future? Is there a technical improvement other than the use of open hardware/software? The price itself should not be a sole focus, as some existing papers describe similarly priced drifters.

2. Why is a 2-day battery a design criterion? Is there a specific reason for just 2 days? Why not more? How many batteries have been used for powering the board? For most boards, at least 3.3 V are needed for power supply, which requires a minimum of 2x1.2 V batteries. Also, adding a solar panel seems more complicated and unreliable than using a higher capacity battery, since the described battery capacity of 1200 mAh is fairly low. Modern day AA sized NiMH rechargeable batteries have capacities of up to 3 Ah, which would (in theory) increase the battery life to approx. 5 days, thus eliminating the need for a solar panel.

3. A more detailed investigation on power consumption during operation and in deep-sleep mode could be performed and presented. This would allow an interested reader not only to plan the battery lifespan in his own experiment, but also to understand how to potentially improve the power efficiency. Is it possible to measure the consumption and document it in the following version of the manuscript?

4. Line 145 states that the use of five drifters enabled the authors to "quantify the cross-sectional variation in surface water flow velocity". This is a very problematic statement from a hydraulic standpoint as five tracers across a river section is hardly enough for

an adequate estimation of cross-sectional surface velocity distribution. Additionally, as evident in Figures 4 and 5, surface tracers (once released) have quickly converged together and cover less than half of the cross-section. Some researchers have tried verifying the obtained velocity results, for example using ADCP.

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Technical corrections:

1. There are too many small but evident writing mistakes and inconsistencies. These kinds of mistakes severely decrease the quality of the manuscript as they show negligence in the writing process. A good research should also be carefully and clearly presented to fellow scientists. Some (but likely not all) of the mistakes in question are listed below:

a) Lines 3, 12: "tinkering scientist" was sometimes written with quotation symbols, and sometimes without – this should be consistent. Also, what is the definition of the "tinkering scientist"? The term is perhaps too colloquial to be used in a research article.

b) Line 8: Quotation opened but never closed.

c) Line 9: "wireless" should be "wirelessly".

d) Line 15: "mircro" should be "micro".

e) Line 48: Repetition (from the abstract) – this should be avoided.

f) Lines 56, 114, 125, 135, 169: Headings should start with an uppercase letter.

g) Line 125: Typo in the heading.

h) Line 251: Wrong citation formatting.

2. There are many colloquial terms and ambiguities in the manuscript:

a) Line 118: "MCU" is an abbreviation which was never explained prior to this appearance. I assume it means "microcontroller unit", but all abbreviations (except for famous

ones, such as DNA, GPS, . . .) should be explained when they first appear in the text.

b) Line 132: ". . .to give it drag. . ." is a bit too colloquial.

c) Line 133: ". . .this design worked fine. . ." – adjective "fine" should have no place in a scientific article. Also, "fine" relative to which criteria?

d) Lines 147-8: "fished out" should be "retrieved", or something similar.

e) Line 177: "typical geoscientist" – what is a typical (geo)scientist? This is mentioned in several forms throughout the manuscript, and I feel that this is an unsubstantiated generalization; scientist performing data acquisition is likely to have some degree of knowledge on relevant hardware and software. Given the sheer size of available documentation, online tutorials and dedicated tech-blogs, it is highly unlikely that a team of modern-day scientists would have significant problems constructing a modular, microcontroller-based piece of equipment (e.g. Arduino or similar).

f) Lines 190-4: Repeats a part of section 3, lines 165-7.

g) Line 194: Term "GeoChasing" is not explained. You should provide all relevant information or point to other sources which provide this information in sufficient level of detail. Nothing should be left unexplained ("hanging") in the text.

3. Figures should be of better quality. More specifically:

a) Figures 2 and 3 are of very low resolution – hard to read on-screen, and unintelligible once printed. Font size in figures should generally correspond to the font size in the main text.

b) Figure 1 would benefit from a clear identification of different components.

c) Figures 4 and 5 should have some indication of flow direction. I assume that in Figure 5 the bottom part of the image is the upstream region, but this should be clearly indicated.

4. Why is Line 275 after Figures 1 and 2 and not with the other references?

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References:

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