

General comments:

The article is well written and introduces an innovative approach to space instrumentation where the limitation of resources is usually conflicting with the complicity of the scientific goals to be accomplished. Using the strategy of adaptive implementation of different firmware modules in a reprogrammable Field Programmable Gate Array for space applications could revolutionize the way electronics is implemented in future space projects. But the same technology could also be applied to a wide range of Earth-bound applications.

A complication for space applications at least in the near future could be the radiation sensitiveness of the reprogramming features in the used components which seem to have the tendency to fail at a much lower total radiation dose than the performance specification of the programmed operational circuits otherwise indicates. For details see for example the radiation qualification reports from Microsemi/Actel, published in April 2011. Until this problem is overcome, the strategy of changing functionality by partly re-programming the circuit according to operational needs may limit the application to planetary surface programs. This is in line with the application for Mars surface science proposed in this article.

Specific comments:

In the introduction section the authors should at least mention the additional complexity for component firmware verification related to the quality assurance requirements for space instrumentation. The needed additional amount of resources in manpower and integration time might in the worst case outbalance the advantage of the faster initial development process. Also the instrumental overhead for reliably store the downloadable code of the firmware modules to be exchanged should be evaluated, as the reliability requirements for the related storage medium will be higher than for standard processor-based software. This is especially the case if the functionality of the circuit's interface section could be affected: a wrong programming could destroy the attached hardware permanently. It would be informative to include an estimate for the typical time needed to perform a partial reprogramming.

Reports of large dust devils on Earth and Mars are mentioned but no reference is given. Please supply references.

Section 2: The authors should mention the instrument on Mars Pathfinder from which the data were used and the time interval of the used data. Please replace the quote "NASA" with "NASA Planetary Data System" and update the quoted link to the correct one, which is most likely : http://pds-atmospheres.nmsu.edu/cgi-bin/getdir.pl?dir=index&volume=mpam_0001

In the description of the used data, data sampling intervals between 4 s and more than 1 h was quoted. This should directly be correlated here to the expected time scale for the investigated phenomena. Typical dust devils as observed with NASA's Phoenix Lander in the polar region of Mars resulted in pressure drops of about 2 to 5 seconds after which the average pressure level was reached again. This time scale could also be corroborated by camera observations of the passing dust phenomena. Data sets with resolution in the same time frame or worse might not give enough unambiguous information to verify the performance of the developed algorithm.

Section 2.3: The used algorithm strategy should be explained in more detail. The rationale for using the configuration values as listed in table 1 should be explained. Are they auto-adapted via the LTA calculations or statically based on tests with the observational data?

While the usage of integer arithmetic is certainly justified for such a hardware implementation, the authors should evaluate the effect of the introduced errors. The effects to be detected in the data represent only a small fraction of the dynamic range of the data sets, so that rounding effects caused by integer operations could have the same order of magnitude as the data variation caused by a passing dust devil.

What is the data word length used in the data processing chain, especially for the summed squared values?

Technical corrections:

General remark: The technical quality of the included figures should be improved before final publication. Figures 7, 8 and 9 are included but not referenced in the text.

The following part contains suggestions for formal re-phrasing or corrections of possible errors to improve on the readability of the text. They might not always be the optimal solution. In several cases the readability of the text might benefit from a more profound rephrasing rather than following the suggested editorial changes.

page 2,2 missions must >comply with< a very..

4 circuits >cannot< be

8 >an< FPGA (correction to be made throughout the text)

17 radiation and >mechanical shock<

18 >achieved< using

page 3, 6 last 20 >years<

page 4, 2 >Earth<

9 supports >< the reduction

20 dust devils >on< the >Martian< surface

22 >on< Earth

25 .>On< Mars

26 > with a height of more than 10 km<

page 5, 11 The idea about >having< STA and LTA is >that< STA

16 >in< software

21 from >the< Mars Pathfinder

page 6, 12 >seismic< detection

15 compared >with<

16 between them >with< respect

19 > different possibilities have been studied with software built around< STA/LTA

21 value) >Once tested, < they have been

22 algorithms >there< are needed

24 >a< THR value

page 8, 23 shift of >an< integer represents a division by two, so if we can >utilize this replacement, it<
would

page 10, 3 are able to achieve >< configuration parameters

13 right shift >it< will be necessary >to introduce a< new initial stage >for initializing< the content

14 >filled<

15 (up to >the< number

page 11, 6 we have >decided not< to implement

8 algorithm >consists of<

10 >the< other for temperature. The difference >to< the

22 In this section we >< show the performance

26 please re-phrase

page 12, 1 we have >tuned< our dust devils detector The >tuning> process

Walter Schmidt