RockMonitoring

Degree programme: BSc in Electrical- and Communication Engineering | Specialisation: Embedded Systems
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Instable cliffs are a real danger when rock falling can cause major damages to houses and communication infrastructures. This is a non negligible problem in Switzerland where several important traffic links are exposed to rock falling. Monitoring instable cliffs is therefore of major importance, for prevention and alarming. We have developed a device monitoring movements of instable rocks, which is power-optimized, compact, and ready for field use in extreme environments.

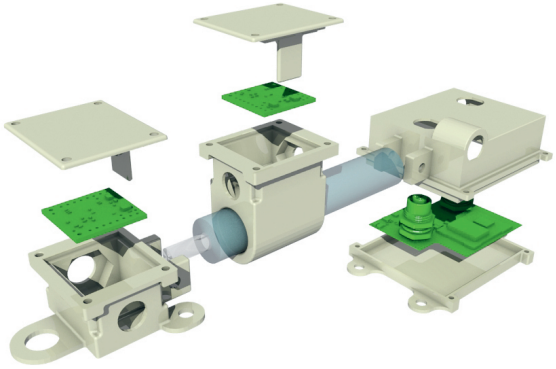
Commercial instable rock monitoring devices are limited to an extensometer measuring the gap changes in a crack or between two instable rock parts. The so obtained data is one dimensional and lacks of important information, such as tilting, which needed in order to reconstruct complete 3D movements of the monitored instable rock parts of the cliff.

The idea of using accelerometers coupled with the extensometer, has been proposed in a previous BFH bachelor thesis. Three accelerometers (one on the extensometer, and one on each of the two fixing point of the extensometer on the rock) provide, together with the extensometer, all the necessary data to reconstruct the 3D movements of the monitored instable rock parts of the cliff. Nevertheless, such a prototype was not ready for field use and needed a major electronic, firmware, and casing/mechanics re-development.

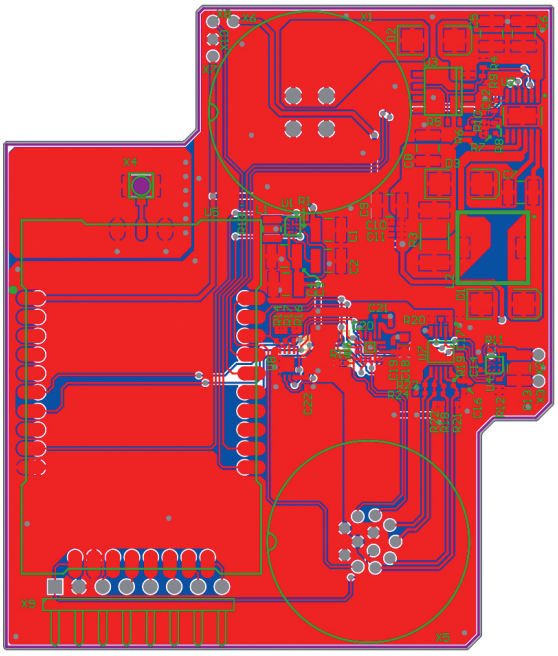
In the present work, we re-developed the system by achieving the following challenging goals:
Prototype Miniaturization, by re-developing both the electronics and the casing, enabling an easy transportation and installation in extreme environments (mountains, steep cliffs), and increasing robustness;
Power consumption reduction, enabling the use of a small solar panel in order to make the device energetically autonomous;
Better power management, optimizing the charging process and the battery control;
Better measuring performances, by optimizing the mechanics of the device;
Better casing and sensor connections, enabling the use in extreme environments (very high and very low temperatures, wind, rain, snow, storm).

The so obtained monitoring device is now ready for field study. Moreover its size and casing enable an easy installation process making possible the use of several systems on the same cliff.

Etienne Houriet



3D assembly view of the system



Main PCB