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Small instrument to volcanic seismic signals

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Currently, the presence of volcanoes represents a threat to their local populations, and for this reason, scientific communities invest resources to monitor seismic activity of an area, and to obtain information to identify risk situations. To perform such monitoring, it can use different general purpose acquisition systems commercially available, but these devices do not meet to the specifications of reduced dimensions, low weight, low power consumption and low cost. These features allow the system works in autonomous mode for a long period of time, and it makes easy to be carried and to be installed.

In the line of designing a volcanic acquisition system with the previously mentioned specifications, exists the Volcanology Department of CSIC, developers of a system with some of these specifications. The objective of this work is to improve the energy consumption requirements of the previous system, providing three channels of data acquisition and with the possibility to transmit data acquisition via radio frequency to a base station, allowing operation it in remote mode.

The developed acquisition system consists of three very low-power acquisition modules of Texas Instruments (ADS1246), and this is designed to capture information of the three coordinate axes. A microprocessor also of Texas Instruments (MSP430F5438) is used to work in low-power, due to it is ready to run this consumption and also takes advantage the power save mode in certain moments when system is not working. This system is configurable by serial port, and it has a SD memory to storage data. Contrast to the previous system, it has a RF communication module incorporated specially to work in remote mode of Lynx (YLX-TRM8053-025-05), and boasts also with a GPS module which keeps the time reference synchronized with module of SANAV (GM-1315LA). Thanks to this last selection of components, it is designed a small system about 106 x 106 mm.

Assuming that the power supply system is working during all the time, except GPS (it works the 1.4% of time) and the RF communications (it works the 20% of time), it has been able to obtain experimental consumption data of prototype developed. That is the reason why the final power supply of system with one channel active is of 110,5mW when using the communication module. If it calculates the power supply without communication, this consumes about 71mW. The new system needs to work at 3.3V, and the calculations have made in base of that. In contrast, the previous system needs 12V, and does not use RF communications. In order to compare those two versions, is used the power supply as reference, up to 696mW in this previous system.

Finally it can be concluded that the implemented electronic design has up to three channels to acquire seismic data, it has the ability to transmit these data by radio frequency to a base station, and power consumption is lower than the initial prototype. The experimental results allow providing an operating time of a year, with weight of 4,84 Kg if the equipment used li-ion batteries.