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Doctoral thesis summary

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Title of the thesis	Caracterización y diseño de sistemas de adquisición y gestión de datos, aplicados a la medición de la actividad sísmica volcánica
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Volcanic eruptions result of the energy stored within the planet are a danger to both populations and to the towns. As inevitable natural events, it is necessary to continue evolving in the study of the physics of the Earth and to maintain a technological breakthrough that allows for better and more effective forecasts. The study of global seismic activity is based on having a network of seismometers and institutions aimed at determining the risk posed by landslides resulting from earthquakes, leaving the specific study of volcanic seismicity in a second plane. Because a volcano may wait thousands of years in inactive phase, it is difficult to convince the authorities responsible of civil protection to maintain the necessary equipment to control volcanic seismicity.

Traditional instrumentation on volcanology uses broadband seismometers which are expensive, bulky, difficult to install and energy-intensive. To all this we must add the possibility that these volcanic monitoring equipment end up destroyed or depleted energy source. A result of which would be necessary some devices whose characteristics include low cost and high autonomy. These equipments do not exist in the market today. Another type of sensor used in most other fields, such as seismic refraction, is the electromagnetic sensor called SM6 that is small-sized, lightweight and also low cost. In this thesis, in order to use it for volcano monitoring, it has been conditioned electronically modifying its transfer function, making it work as well as a broadband sensor type.

The necessity of having the ability to acquire data for long periods of time and with the possibility of remotely transmitting implies that they have high energy requirements. Have been applied in the equipment itself, processing algorithms seismic information STA / LTA (Short Term Average / Long Term Average) so once interesting events are detected, perform sending the data, with the consequent messages reduction, and hence an increased autonomy of the team.

In order to determine the consumption of volcanic monitoring system proposed, have been evaluated each of its components. Then have been analysed different types of piezoelectric sensors (Murata 7BB-35-3L0, Volture v21b) in order to determine the amount of electrical energy that can be obtained from the medium. The initial proposal where is combined the use of a disc-shaped piezoelectric and a pendulum striking the piezoelectric, has been discarded due to low efficiency and the high piezoelectric degradation. Alternatively, there has been designed a prototype of Savonius mini-turbine with Volture v21b sensors, all of it with a sprocket on rotor rubbing piezoelectric element. Finally, the design has been optimized so that the piezoelectric is always at optimum mode of power generation by vibration, determining the ideal distance between the sprocket and the number of piezoelectric needed to provide power for monitoring volcanic system.

The end result of thesis work has allowed the realization of a compact seismic acquisition, low-power, long-range telemetry and lightweight for easy transport. The equipment has been validated in the laboratory by automated measuring systems and calibration procedures. Its design has been tested in different measurement campaigns in the islands of El Hierro and Tenerife, by comparisons with reference equipment and high performance, from the Instituto Geográfico Nacional devices.

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Signature