

Intelligent hybrid systems to monitor rock toppling: the Rialba deployment

Description

The Torrioni di Rialba (Abbadia Lariana - LC, Italy) is a rock tower-like conglomerate divided by a system of fractures yielding to a set of columns. The monitoring system of the Torrioni was designed to anticipate and assess the risk of rock toppling. The system is composed of two parts inspecting different phenomena. The first is deployed at the base of the column, the second at its top. The lower system is a hybrid wireless-wired sensor network that inspects the insurgence of micro-cracks within the rock (mems accelerometers acquire micro-acoustic emissions associated with the generation of micro-cracks and their coalescing in fractures). The lower system also retrieves information related to the flow of two water

streams at the lower part (water springs from fractures that separates the towers).

The upper system is composed by a Wireless Sensor Network (WSN) that measures changes in the structure of the tower (enlargement of fractures, inclination, together with the zone pluvial data). All this information is routed to a server that stores, analyzes and presents data. The same server remotely controls the operations of the sensor networks hence reducing the need of in-situ maintenance.

All modules composing the monitoring system are designed to operate in the wilderness, harvesting the energy they need from the environment through solar panels and react to changes when needed.

Sensors

Microfracture investigation:

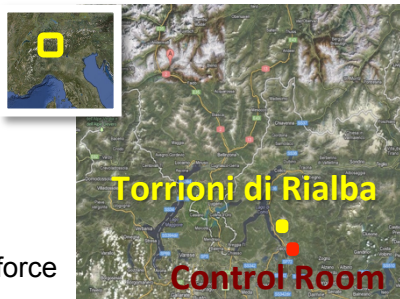
- 3 Accelerometers (MEMS)

Fracture enlargement investigation:

- 6 Inclinometers (3 force balance, 3 MEMS)
- 3 Crackmeters (wire crackmeters)
- 9 Thermometers (6 PT100 and 3 digital integrated sensors)

Precipitation investigation:

- 1 Rain Gauge
- 2 Piezometers



A wireless gateway



Deployment area



Wireless technology
3 Wireless Sensing Units
1 Wireless Gateway



Wireless-wired technology
4 Wired Sensing Units
1 Wireless Gateway

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