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Real-time landslide monitoring system using UWB radio transceiver as a sensor

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Wireless sensor networks (WSN) have attracted great interest in recent years, particularly because of the improvements in Micro-Electro-Mechanical Systems (MEMS) technology. These devices, such as accelerometers, GPS, IMUs, temperature, pressure and humidity sensors, are available now at an affordable cost. Sensor nodes can sense, measure, and gather information when deployed on field and, based on specific routing and transmission protocols, they can send sensed data to the user, usually through radio connection. The features mentioned above have made them a suitable tool for slope monitoring, where environment and operating conditions are often challenging and the cost of human intervention for deployment and maintenance is high. Furthermore, WSNs can constitute the basis for an early warning system framework, which includes gathered data analysis and forecasting (by using thresholds and/or expert judgment), risk scenarios identification, warning dissemination and people response. Thus, a passive monitoring network can be transformed into a proactive system, embedded inside the decisional workflow for the emergencies management.
This is a preliminary study aimed at testing an innovative low cost WSN for slope monitoring (with the possibility to be adapted to buildings and structure). In the system we are purposing, the sensor nodes are Ultra Wide Band (UWB) transceiver. The main idea is to study, test and deploy a network composed of several devices, using signal triangulation methods to determine the position of each node, at first in an arbitrary and then in an absolute reference system.
The most challenging goals are i) to reach an adequate measurement accuracy and ii) to ensure a working life of the network comparable to standard system. They both are not trivial problems, especially because the radio apparatus (with reference to traditional WSNs) in a sensor node is highly draining in terms of energy compared to the other embedded devices. The solutions to these problems can be technical, choosing the best hardware and using high performance batteries, or IT, developing efficient transmission protocols and optimizing measurement cycles. Clearly the result will necessarily have to be a trade-off between the measurement needs and the longevity of the network.