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Landslide and Flood Warning System Prototypes based on Wireless Sensor Networks

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Wireless sensor networks (WSNs) are one of the emerging areas that received great attention during the last few years. This is mainly due to the fact that WSNs have provided scientists with the capability of developing real-time monitoring systems equipped with sensors based on Micro-Electro-Mechanical Systems (MEMS). WSNs have great potential for many applications in environmental monitoring since the sensor nodes that comprised from can host several MEMS sensors (such as temperature, humidity, inertial, pressure, strain-gauge) and transducers (such as position, velocity, acceleration, vibration). The resulting devices are small and inexpensive but with limited memory and computing resources. Each sensor node contains a sensing module which along with an RF transceiver. The communication is broadcast-based since the network topology can change rapidly due to node failures [1]. Sensor nodes can transmit their measurements to central servers through gateway nodes without any processing or they make preliminary calculations locally in order to produce results that will be sent to central servers [2].
Based on the above characteristics, two prototypes using WSNs are presented in this paper: A Landslide detection system and a Flood warning system. Both systems sent their data to central processing server where the core of processing routines exists. Transmission is made using Zigbee and IEEE 802.11b protocol but is capable to use VSAT communication also. Landslide detection system uses structured network topology. Each measuring node comprises of a columnar module that is half buried to the area under investigation. Each sensing module contains a geophone, an inclinometer and a set of strain gauges. Data transmitted to central processing server where possible landslide evolution is monitored. Flood detection system uses unstructured network topology since the failure rate of sensor nodes is expected higher. Each sensing module contains a custom water level sensor (based on plastic optical fiber). Data transmitted directly to server where the early warning algorithms monitor the water level variations in real time. Both sensor nodes use power harvesting techniques in order to extend their battery life as much as possible.

[1] Yick J.; Mukherjee, B.; Ghosal, D. Wireless sensor network survey. Comput. Netw. 2008, 52, 2292-2330.
[2] Garcia, M.; Bri, D.; Boronat, F.; Lloret, J. A new neighbor selection strategy for group-based wireless sensor networks, In The Fourth International Conference on Networking and Services (ICNS 2008), Gosier, Guadalupe, March 16-21, 2008.