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Design of a low-cost and open-source sensor node for landslide monitoring oriented to IoT early warning system: a case of study in alpine areas

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The concept of Internet of Things (IoT) is gaining increasing attention, in particular because of the continuous investments in telecommunication services and the development of new miniaturized systems. Nowadays, it is possible to prototype low-cost measurement systems that integrate several types of sensors with the capacity for local processing and data transmission into one single system. One of the main advantages of the IoT philosophy is that it is supported by a large community of open-source developers who freely publish their own codes, setup and hardware architectures. On the one hand, it accelerates the process of prototype creation while on the other hand, it is possible to replicate the measurement system able to rapidly constitute an extensive monitoring network hosted by oriented web portals.

In this work, we combine the IoT philosophy with the development of a sensor measurement node for landslide monitoring in Corvara in Val Badia, in the Italian Alps. The system consists of one 16 MPix DLSR camera for photogrammetry analysis controlled by an Arduino electronic board (microcontroller) for time-lapse acquisitions. A Raspberry Pi electronic board (microprocessor) configures the camera, manages storage and transmission of data and provides the security for uploading information in a dedicated remote server. It also acts as interlocutor between remote user and task management system. Additional information is collected by means of a microcontroller with specialized sensors including low-cost GPS and accelerometer (spatial and temporal information necessary for photogrammetry analysis), low-cost & low-resolution camera (early warning information), soil measurements (water content and temperature) and air temperature. The system aims to upload the generated information to a web application service that is able to compare the movement of specific objects in time with the help of an early digital surface model (time zero) retrieved by aerial photogrammetry (UAV-based).