



The use of Unmanned Aerial Vehicles in monitoring applications and management of natural hazards

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In the last years following the damages derived by the climate change (such as flooding and so on) it is growing the necessity to monitor the watercourses with effective and quickly method, where low cost solutions are particularly interested.

In some cases, it is essential to have information about the riverbed, the river banks and to analyze the springs and the way in which the water moves.

For the terrestrial point of view this knowledge can be acquired through GNSS and topographic methods, but they are still too manually so that they are time-consuming with respect the acquisition of information about the entire area.

Another possibility is to perform a laser scanner survey, but the most common instruments (economically sustainable) have some problems to acquire information of sub-water-layer.

Moreover, terrestrial surveys from cameras (such as visible, thermic or hyperspectral sensors) can't always offer a useful view of the case study due to the fact that they have a limited range of possible points of acquisition.

For these reasons, it can be more effective to have an aerial point of view of the river, for example using UAVs (Unmanned Aerial Vehicles), which have been experimented in these last years for environmental investigations.

The proposed studies include photogrammetric and thermographic applications in order to investigate a new post-flooding riverbed arrangement and to identify some sub-riverbed springs inside a stream in order to monitor the behavior of two studied watercourses.

The tests have been carried out with a customized low-cost mini-UAV based on the Mikrokopter Hexakopter solution embedded with a navigation system for the autonomous flight (GNSS/IMU) and with the possibility to house different kind of sensors, such as a camera, a GNSS receiver, a LiDAR sensor, a thermographic camera and more other sensors, but with the limitation of a 1.2 Kg payload.

The most significant innovation is the possibility to perform quickly and economical acquisitions and to acquire the data in an autonomous way. The acquisition and the storage of the data can be fully automatic and can be performed through a dedicated embedded pc (for example, in the case of the thermography a dedicated on-board pc is needed) or with special cables (it is the case of the camera for the photogrammetric acquisitions) that give the pulse to acquire the data.

Using these systems it is possible to have a large amount of data in a short time. This permits to quickly process the photogrammetric data with a SFM (Structure From Motion) approach and extract 3D information in terms of sections, 3D models, riverbed reconstruction, orthophoto; furthermore the thermal information can be immediately read using dedicated software.

All these data can be also the basis for specific detailed investigations.