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'Feasibility-Assessment of a Drone-borne Ground Penetrating Radar Sensor for Humanitarian Applications in the context of Disaster Management'

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In this paper we shall address the scientific issues that will determine the functional capability of a drone-borne ground penetrating radar sensor for humanitarian applications, particularly in the context of disaster management.

The attenuation and dispersion of radar signals penetrating into the Ground will determine the ultimate applicability of a drone-mounted radar sensor capable of registering useful radar echoes for observing and monitoring sub-surface objects and features. The functionality of the radar will thus be assessed in dependence of key radar parameters that include, the main radar frequency, modulation depth, radar mode of radar operation (pulsed FM, FM-CW), the antenna type, available power-budget.

In the analysis to be presented, the radar equation will be used to simulate the radar echoes under different conditions arising from the chosen key-radar parameters and the assumed the propagation properties of the sub-surface earth medium. The analysis to be presented will clearly indicate whether or not drone-borne ground penetrating radar is a feasible idea and that it could be constructed with the technologies available today.

The main challenge addressed in this contribution is the estimation of wave attenuation and dispersion that takes place once the radar signal has penetrated into the sub-surface region. In this regard, realistic range of values of the electrical properties of soil and water volumes will be drawn out from open literature. In the area of hardware realization, the key problem will be to have a final radar-unit weighing no more than a few Kilograms that can be mounted, powered, and flown on a small drone based on a 'copter' type of carrier capable of autonomous operation.

Main application of the sought ground-penetrating drone mounted radar would be to detect not only to image the sub-surface environment but also to detect human beings buried under debris generated by landslides or collapse of buildings.