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# Inertial and GPS data integration for positioning and tracking of GPR

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Nowadays many applications and studies use a Global Positioning System (GPS) to integrate Ground-Penetrating Radar (GPR) data [1-2]. The aim is the production of detailed detection maps that are geo-referenced and superimposable on geographic maps themes. GPS provides data to determine static positioning, and to track the mobile detection system path on the land. A low-cost standard GPS, like GPS-622R by RF Solutions Ltd, allows accuracy around 2.5 m CEP (Circular Error Probability), and a maximum update rate of 10 Hz. These accuracy and update rate are satisfying values when we evaluate positioning datum, but they are unsuitable for precision tracking of a speedy-mobile GPR system. In order to determine the relative displacements with respect to an initial position on the territory, an Inertial Measurement Unit (IMU) can be used. Some inertial-system applications for GPR tracking have been presented in recent studies [3-4]. The integration of both GPS and IMU systems is the aim of our work, in order to increase GPR applicability, e.g. the case of a GPR mounted on an unmanned aerial vehicle for the detection of people buried under avalanches [5]. In this work, we will present the design, realization and experimental characterization of our electronic board that includes GPS-622R and AltIMU-10 v3 by Pololu. The latter comprises an inertial-measurement unit and an altimeter. In particular, the IMU adopts L3GD20 gyro and LSM303D accelerometer and magnetometer; the digital barometer LPS331AP provides data for altitude evaluation. The prototype of our system for GPR positioning and tracking is based on an Arduino microcontroller board.

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