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Towards an automated mobile GPR acquisition system for road and bridge monitoring

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Mobile GPR acquisition units have been used for several years for the inspection of roads and bridges. Empa's mobile acquisition unit has been in use since about 15 years. Since then, a large number of objects has been inspected successfully. Today, data acquisition is done optimized for a specific purpose on a certain object. This results in a dataset gathered specifically for this purpose but requires a special data acquisition campaign for every project. Today, about six million vehicles are using the Swiss motorway network every day. Many vehicles are travelling large distances regularly. The basic idea of our research and development project is to equip one of those vehicles with an automated acquisition system. This system would collect GPR data incessantly leading to huge and partially redundant amounts of data. These datasets could be stored and accessed if required. Main challenges during the development of such a system are automation, the connection between GPR and GPS systems and the handling, processing and structured storage of huge datasets.

The automated measurement system that is currently under development consists of a GSSI SIR-20 GPR system in conjunction with a Trimble 5700 GPS system. The SIR-20 is used with wide-band horn antennas, it's data acquisition is performed distance-based using an odometer wheel. The GPS receiver records the raw GPS observation data including C/A in L1, P-Code in L2 and Carrier-Phase with L1 and L2 providing enough coverage. Combination of the position information obtained from the GPS receiver and the GPR data is done as follows: The GSSI Radan Software is controlled with a scripting system that adds markers to the radargram at fixed intervals, provided the system is acquiring data. For each marker the scripting system records the time resulting in a timetag. These timetags determine the spatial position of radar traces. The position information is stored in a PostGreSQL database with Post-GIS extension. Data can be accessed and extracted via a user friendly web-interface for data processing and interpretation using standard software tools. Currently the system allows automated data acquisition at speeds up to 80 km/h with a spatial sampling rate of 5 traces/m. An electronic supplement is currently developed which omits the clock misalignment issue allowing position accuracies up to the GPS accuracy level.

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