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Multi-Sensing system for outdoor thermal monitoring: Application to large scale civil engineering components

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Aging of transport infrastructures combined with traffic and climatic solicitations contribute to the reduction of their performances. To address and quantify the resilience of civil engineering structure, investigations on robust, fast and efficient methods are required. Among research works carried out at IFSTTAR, methods for long term monitoring face an increasing demand. Such works take benefits of this last decade technological progresses in ICT domain.

The present study follows the ISTIMES European project [1], which aimed at demonstrate the ability of different electromagnetic sensing techniques, processing methods and ICT architecture, to be used for long term monitoring of critical transport infrastructures. Thanks to this project a multi-sensing techniques system, able to date and synchronize measurements carried out by infrared thermography coupled with various measurements data (i.e. weather parameters), have been designed, developed and implemented on real site [2].

Among experiments carried out on real transport infrastructure, it has been shown, for the “Musmesci” bridge deck (Italy), that by using infrared thermal image sequence with weather measurements during sevral days it was possible to develop analysis methods able to produce qualitative and quantitative data [3].

In the present study, added functionalities were designed and added to the “IrLAW” system in order to reach full autonomy in term of power supply, very long term measurement capability (at least 1 year) and automated data base feeding. The surveyed civil engineering structures consist in two concrete beams of 16 m long and 21 T weight each. One of the two beams was damage by high energy mechanical impact at the IFSTTAR falling rocks test station facilities located in the French Alpes [4]. The system is composed of one IR uncooled microbolometric camera (FLIR SC325) with a 320X240 Focal Plane Array detector in band III, a weather station VAISALA WXT520, a GPS, a failover power supply and a backup system. All the components of the system are connected to the IrLaW software through an IP network. The monitoring system is fully autonomous since August 2013 and provides data at 0. Hz sampling frequency. First results obtained by data post-processing is addressed. Finally, discussion on experimental feedback and main outcomes of several month of measurement in outdoor conditions will be presented.

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