Enhancing Safe Train Localization using Data Fusion from Heterogeneous Sensors

Salvatore Sabina (salvatore.sabina@hitachirail.com), Giorgio Buttazzo (giorgio.buttazzo@santannapisa.it)

Abstract:

The main objective of a railway signaling system is to guarantee the **safe movement** of trains with required operational performances. The current European Rail Traffic Management System (ERTMS) imposes the minimum performance requirements mandatory for guaranteeing the interoperability, i.e. the ability of a rail system to allow the safe and uninterrupted movement of trains within the European Union. An example of such a performance requirement is that the accuracy associated with every measured distance s has to be better or equal to $\pm$ (5m +5% s) in **all** the railway nominal operational and environmental scenario. As the measured distance and the associated confidence interval contribute to the estimation of the Train position and the Train confidence interval, the **odometry** and the **train position** are two critical hard real time functions of a train on-board subsystem with impact on **safety** and the global **railway system performance**.

In order to make railway operations more economic and improve the competiveness of the rail transport mode with respect to the other different transport modes, in the last years, many Infrastructure Managers and Railway Undertakings have asked for **standard solutions** capable of reducing the CAPEX and OPEX costs of railway command and control systems.

Our presentation will describe the preliminary results of a current R&D initiative activated by Hitachi Rail STS with S. Anna with the objectives of (a) investigating enhancements of the odometry function to provide better performances and (b) innovative safe train position solutions by a combined use of different sensors such as wheel sensors, GNSS, IMU, and Lidar. In addition, the use of an on-board Digital Map has also been investigated to mitigating some hazards associated with the use of these technologies in the high demanding railway environment.

Keywords: Safety, hard real time, multi sensors, train localization, train odometry