A Simulation Design of an Integrated GNSS/INU, Vehicle Dynamics, and Microscopic Traffic Flow Simulator for Automotive Safety

This article describes the development of a comprehensive, integrated GNSS/INU traffic simulator consisting of a microscopic traffic simulator based on VISSIM, a vehicle dynamics simulator based on CarSim, and a GNSS/INU simulator. The authors stress that this simulator offers an integrated design, test and evaluation platform for exploring new ideas, developing advanced concept designs, and investigating the impact of existing and emerging Global Navigation Satellite Systems (GNSS) and Inertial Navigation Unit (INU) technologies for enhanced automotive safety at the vehicle and network levels. The authors describe the role of each of the components and then pose situations where the components all work together. The VISSIM identifies situations where safety warning events are generated on the basis of surrogate safety indicators (e.g., time to collision). CarSim generates simulated 'ground truth' vehicle trajectory and orientation information based on VISSIM’s simulated initial driving conditions, vehicle type, driver aggressiveness and road geometry. The GNSS/INU simulator computes instrumental, environmental and system errors. In addition, the system includes a simulated driver or automated vehicle response to test the potential crash scenario. The authors conclude that their proposed
GNSS/INU simulator has the functionality to model a variety of GNSS devices, ranging from smartphones to high-accuracy cm-level geodetic RTK GNSS receivers and a variety of INU units.

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