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RaspberryTracking: Autonomous, low-cost positioning measurement system for vehicles in railway operations for research and development purposes

The digitalisation of railway operations, vehicles and infrastructure maintenance have a high potential to improve the efficiency, reliability, and attractiveness of the rail system as a whole. These improvements will ultimately result in a further modal shift to rail, in turn lowering emissions from transportation, and thereby helping Europe achieve the objectives of the European Green Deal. The development of these new technologies however requires gathering a substantial amount of real-life operational data, which has as yet proven difficult in practice. By effectively measuring the precise vehicle position, speed and acceleration, new tools can be developed to improve operations, such as data-driven maintenance strategies, simulation and prediction of energy consumption and driver assistance systems.

To address this issue, an autonomous, low-cost and easy-to-implement GNSS measurement system has been designed and implemented for this research purposes, enabling precise positioning measurements to be taken from a rail vehicle with little to no impact on railway operations. The system, known as RaspberryTracking, consists of a single-board computer, a high-grade GNSS module, an LTE network module for remote communication and an autonomous power supply. Additionally, the system uses a web interface, allowing for remote monitoring and control of the measurement system. This contribution presents the functionalities of the system, and requirements which led to its current design. A prototype system has already been constructed and used to gather 10.000+ km of measurements on a rail car operated on the German railway network. Technology gaps and further possible developments of the system are discussed.