

GPS-equipped Wireless Sensor Network Node for High-accuracy Positioning Applications

Bernhard Buchli, Felix Sutton, Jan Beutel

Computer Engineering and Networks Laboratory, ETH Zurich, Zurich, Switzerland
{bbuchli, fsutton, jbeutel}@ethz.ch

Abstract This work presents the design, implementation and end-to-end system integration of a wireless data acquisition system for real-time, high-accuracy positioning applications. The system concept for a GPS-equipped wireless sensor network is introduced, and its advantages over existing geodetic positioning solutions are highlighted. A wireless network of GPS-equipped sensor nodes, built from low-cost off-the-shelf components, autonomously acquires L1 GPS data for Differential GPS (DGPS) processing of raw satellite information. The differential processing on the backend infrastructure yields relative position and motion of individual nodes within the network with sub-centimeter accuracy. Leveraging on global GPS time synchronization, network-wide synchronized measurement scheduling and duty-cycling coupled with power optimized operation and robustness against harsh environmental conditions, make the introduced sensor node well suited for a variety of monitoring or surveying applications in remote areas. Unattended operation, high spatial and temporal coverage and low cost distinguish this approach from traditional, very costly and time consuming approaches. The prototype data acquisition system based on a low-power mote equipped with a commercially available GPS module has been successfully implemented and validated in a testbed setting.