With the increasing demand for seamless and continuous navigation in GPS-challenged environments, such as indoors or areas subject to interference, the concept of GPS augmentation in a form of multi-sensor integration has been developed and implemented in the past years. These systems, however, have their own accuracy and sustainability limitations, and thus, a recent concept of collaborative navigation, with the objective of improving navigation accuracy and continuity of a group of users, has been proposed. Cooperative navigation can be considered an extension of the concept of multi-sensor integration to further improve the navigation capability of a group of users, referred to as network nodes. The premise is that a network of GPS users may collectively receive sufficient satellite signals, augmented by inter-nodal ranging and other sensory measurements to achieve joint position determination.

This paper presents the concept and the algorithmic approach of a new technique for robust GPS positioning in a multi-sensor network using RF ranging signals among the network nodes. The preliminary performance assessment, based on simulated and field data, demonstrates the ability of a network of users to operate under GPS-challenged conditions, in which navigation of an individual user would be impossible or grossly inaccurate. The experiments verified that collaborative navigation solution significantly improved the results of the individual navigation solutions for all test scenarios. Further improvements are expected with the ongoing refinements and optimization of the collaborative navigation algorithms. In addition, primary research challenges are discussed, related to the design and implementation of a collaborative navigation system.