

The Fourth Layer in Collaborative Navigation – Going Underground

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Key words: GNSS/GPS; Low cost technology; Positioning;

SUMMARY

Collaborative navigation is the method for determining the location of a group of users or sensor platforms absolute and relative to each other. Thereby users are equipped with different sensors of varying quality in terms of performance and achievable positioning accuracies. The concept arose from and follows up the multi-sensory approach where one user has different sensors, such as GNSS receiver, IMU, accelerometers, digital compass and gyro, barometric pressure and step sensor, image sensors including digital cameras and Flash LiDAR, as well as UWB receivers, Wi-Fi and RFID. Now a network of user groups is located and they share their information among each other. In the beginning of the concept development, only two layers have been considered for collaborative navigation which were the ground level where the group of users had to be navigated, next came spaceborne satellite navigation systems. Due to the recent introduction and use of Unmanned Aerial Vehicles (UAV's) or other flying objects, such as helicopters or light aircrafts, this concept has then been extended with a third layer – the airborne layer in between the ground and the satellites. The author of this article proposes to introduce an additional fourth layer into the concept, namely the underground. In cities a branched network of tunnels such as underground public transportation tunnels, road tunnels, subways, sewer canal systems, etc. is present. In this paper the question is raised why we are not using these underground structures, for instance, to guide emergency crews to the affected area and rescue people when it is not possible to perform this task above ground. In this paper, possible underground structures are identified and suitable localization technologies for the underground environment in conjunction with users above ground are elaborated and discussed. Thereby, special emphasis is placed on the use of RFID as an easy to deploy absolute positioning technology. As the author believes that the underground will play an important role for such application scenarios, he calls upon the research community of geodesists and researchers in related fields for international collaboration and participation to develop this idea further. His call is formulated as: Let's extend the layers of the collaborative navigation concept with "Going underground"!