

Progress in Integrated Positioning, Navigation and Mapping Systems

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SUMMARY

The current market in positioning and navigation is clearly dominated by GPS. GPS is capable of providing the required positioning accuracy in all situations where uninterrupted signal reception is possible and the general satellite geometry is within acceptable limits. It is also evident that other navigation technologies are currently not capable of providing similar accuracies at a comparable price, i.e. there is not real competition to GPS in a scenario of uninterrupted signal reception. This leaves two scenarios to be considered. The first one is that of intermittent signal reception, as for instance in heavily forested areas or in urban centers. The other one is that of no signal reception at all, as for instance in buildings, underground or underwater. In the first case, GPS has to be integrated with other sensors to bridge periods of no signal reception. In the second case, GPS has to be replaced by another system that can provide continuous navigation in those environments where GPS does not work. Both cases will be treated in this paper where the integration of systems and navigational aids (navaids), will be investigated as an alternative for times of GPS signal blockages. In terms of systems, both Inertial Navigation Systems (INS) and vision-based systems will be considered. In terms of navaids, odometers, gyros and digital maps will be considered for land vehicle navigation, and pedometers, magnetic compasses, digital maps, and cellular phones for personal navigation systems. The integration of these technologies will, therefore, provide a system that has superior performance in comparison with stand-alone systems. In general, the fact that redundant measurements are available for the determination of navigation parameters greatly enhances the reliability of integrated systems. The paper will cover both, the concept of integration and implementation aspects of integrated systems. Examples on current and future systems for mapping, positioning, and navigation applications will be given. Current applications with some of the corresponding obtained results are given and the future outlook of the emerging applications will be discussed.

This paper is part of the progress in research and development related to my WG C.53 on "Integrated Positioning, Navigation and Mapping Systems"

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