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Special Issue on IEEE IV 2012 Workshops: Part 1 of 2

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Rafael Toledo, David Bétaille,
and Miguel Ángel Sotelo



Special Issue on IEEE IV 2012 Workshops: Part 1 of 2

The 2012 IEEE Intelligent Vehicles Symposium Workshops took place on 3rd of June 2012 in Alcalá de Henares (Madrid), Spain, at the Hotel Parador de Alcalá de Henares. Six workshops were offered to an audience of 120 researchers from the entire world:

- W1: First International Workshop on IPv6-Based Vehicular Networks (Vehi6)
- W2: Workshop on Human Factors in Intelligent Vehicles
- W3: Workshop on Navigation, Perception, Accurate Positioning and Mapping for Intelligent Vehicles
- W4: Advances in Heavy Vehicle Safety, Energy Efficiency, and Controls
- W5: Perception in Robotics
- W6: Workshop on Ambient intelligence for tomorrow's intelligent transportation systems.

The authors of the papers with the best reviews were invited to this Special Issue, agreed by the Editor in Chief of the *IEEE ITS Magazine*, the IV2012 General and Workshop Chairs and each Workshop Organizer. It is now our pleasure to have it ready for publication in the Magazine.

Initially, 10 papers were selected out of 55 technical and scientific workshop papers. Selection was based according to the

scores and comments provided by the reviewers, associate editors and workshop organizers. Positive response from authors of 8 of the selected publications was received and their manuscripts, as extended versions of their IV'12 Workshop articles, were duly submitted for this Special Issue. All of the submitted papers went through the rigorous revision process of the *IEEE ITS Magazine*, and eventually 6 of them were accepted. These 6 papers are authored by researchers from Chile, France, Spain and the USA. Due to the high number of accepted papers, the Editor in Chief of the Magazine and the Special Issue organizers agreed to divide it in two parts, with 3 articles on this fall issue and the other 3 left for the winter one.

First 3 papers are introduced next. All of them focus on the topic of accurate positioning and trajectory determination. This is a crucial field of the Intelligent Transportation Systems, as most ITS applications and services on Intelligent Vehicles demand accurate and reliable positioning determination. These 3 papers represent the most cutting-edge research of the field, with innovative ideas that will surely inspire researchers of the field in many ways, presented by the authors in a sound way and validated with excellent results.

The first paper in this issue by Vicent Drevelle and Philippe Bonnifait, with the title "Reliable Positioning Domain Computation for Urban Navigation", addresses the topic of integer vehicle positioning in built-up areas by means of tightly coupling a GPS receiver with a 3D-map of the drivable area. Interval analysis is employed to solve the constraint positioning problem using contractions and bisections. Integrity is provided through the use of a robust set-inversion scheme applied to a redundant measurement set. If the prior distribution of the measurement noise is known, it is possible to compute confidence domains that correspond to a given integrity risk, which is often set very low out of safety considerations. A way of validating the proposed approach using real experiment dataset and a ground truth equipment is also examined by the authors. Different tunings of the method, corresponding to different risks, are assessed in terms of availability and integrity in order to compute statistical metrics. Results shown by the authors indicate that this methodology is relevant since the specified risk corresponds to experimental observations.

The second paper by David Bétaille, Francois Peyret, Miguel Ortiz, Stéphane Miquel and Leila Fontenay also introduces 3D-maps

as a key element to improve GPS receivers positioning, confirming the interest of this trend. In particular, in this article 3D data are used to determine the Non-Line-Of-Sight (NLOS) satellites in real time, while the vehicle moves, obtaining significant benefit in terms of navigation accuracy. The idea developed in this paper consists in proposing a method, light in terms of information contents and computation throughput, for taking into account the knowledge of the 3D environment of a vehicle in a city, where multipath phenomena can cause severe errors in positioning solution. This method makes use of a digital map where homogeneous sections of streets have been identified and classified among different types of urban trenches. This classification is so called: "Urban Trench Model". Not only NLOS satellites can be detected, but also, if needed, the corresponding measurements can be corrected and further used in the positioning solver. The authors present in details the method and its results on several real test sites in France, with a demonstration of the gain obtained on the final position accuracy.

The third paper by Anh Vu, Jay A. Farrell and Matthew Barth, with the

title "Centimeter-Accuracy Smoothed Vehicle Trajectory Estimation", introduces advances in the field of lane-level positioning accuracy and reliability. In particular, the contribution of the paper is on the problem of accurately and reliably estimating a sensor platform trajectory in a post-processing environment, providing support to the process of attaining the requisite roadway map accuracy via post-processing and real-time vehicle positioning accuracy and reliability. The article describes a smoothing framework for estimating sensor platform trajectories using an Inertial Measurement Unit (IMU) and a dual-frequency GPS pseudo-range and carrier-phase receiver. A Bayesian estimation framework is presented and transformed to a series of nonlinear least squares problems. The result of this optimization process is the platform trajectory estimate at the IMU measurement rate (200 Hz) with position accuracy at the centimeter level. One of the contributions of the authors is the method developed to solve for the carrier-phase integer ambiguities. The article includes real-world experimental results to prove the validity of the proposed smoothing framework.

We want to thank the authors of invited papers for their high quality contributions. It is our hope that this Special Issue of the *IEEE ITS Magazine* will be appealing for the readers and will help to intensify and extend the research towards better Intelligent Vehicles.

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