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Editorial

Sensor Communications towards Intelligent Vehicle Networking

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1. Introduction

Sensor technologies have been widely used to make transportation clean, efficient, connected, and safe. Roadside wireless sensor and networking technology represents a cost-effective solution and can leverage the deployment of the system as a whole. Sensors installed in cars continuously gather important information, such as air bags, distance detection, mechanical and electronic parts, tire pressure, collision force, and passengers' conditions. Transmission of such information between cars can be used to implement differentiated mobile services. As a consequence, Wireless Vehicular Sensor Network (VSN) has been widely accepted in developing the next generation intelligent transportation application systems as well as connected vehicles networking. However, VSN does not operate like the traditional wireless sensor network (WSN). For example, the motion of the vehicle, the environment of the roads, and other uncertain traffic conditions all pose challenges to the system. For safety reason, the vehicle-vehicle and vehicle-gateway communication modes must be stable. Therefore, how to keep link stability becomes an important issue.

This special issue is in response to the increasing convergence of distributed sensor networks. Papers selected for this special issue represent recent progresses in the field, including works on mobility architectures, vehicle communications and networking, algorithms in wireless sensor networks, and services and applications in distributed systems. All of these papers not only provide novel ideas and state-of-the-art techniques in the field but also stimulate future research in the sustainable environment.

2. Architecture and Mobility

Information representation and query processing are two core problems of event-based distributed systems such as VANETs. To speed up the online query in distributed event-based system, the paper entitled "Summary Instance: Scalable Event Priority Determination Engine for Large-Scale Distributed Event-Based System" by R. Shi et al. introduces the rule storage schema based on rule instantiation method with Bloom filter technique. This approach leverages offline efforts to increase the online query speed. This approach is promising to provide an efficient scalable design for event priority determination problem in large-scale distributed event-based systems.

The paper entitled "A Mobility Model for Connected Vehicles Induced by the Fish School" by D. Tian et al. proposed a mobility model of connected vehicles with wireless communications. The proposed model consists of the attraction of the goal, the repulsion of the obstacles, the constraint of the road, and the interplays of vehicles in the group including both attractive and repulsive affection. Simulations were performed to verify that the wireless communications among vehicles can improve the safety and efficiency of traffic greatly, and the numerical experiments prove the reasonableness of the model in terms of describing the cooperative behaviors of connected vehicles with wireless communications.

The paper entitled "A Hierarchical Reputation Evidence Decision System in VANETs" by Y. Yang et al. proposed a dynamic three-layer reputation evidence decision and management mechanism. The system helps in collusion avoidance

through reporting falsified reputation evidences of colluders. In addition, an adaptive reputation evidence gathering cycle is presented to replace frequent polling mechanism and save the network traffic. The simulation results demonstrate that the proposed architecture has high performance of detection for selfish and collusive behaviors.

3. Algorithms and Information Fusion

With the rapid growth in the number of vehicles, energy consumption and environmental pollution in urban transportation have become a worldwide problem. Efforts to reduce urban congestion and provide green intelligent transport become a hot field of research. The paper entitled "A Multimetric Ant Colony Optimization Algorithm for Dynamic Path Planning in Vehicular Networks" by Z. Wang et al. presents a multimetric ant colony optimization algorithm to achieve real-time dynamic path planning in complicated urban transportation. Based on multiple traffic information and planning requirements, the proposed algorithm selects the most effective and suitable planning path. This algorithm provides a potential solution for energy consumption and environmental pollution in increasingly complex urban traffic environment, which could be used in Intelligent Transportation System.

The paper entitled "Accurate Real-Time Traffic Speed Estimation Using Infrastructure-Free Vehicular Networks" by Z. He et al. proposed a novel in-network traffic speed estimation approach using infrastructure-free vehicular networks. The proposed solution utilizes macroscopic traffic flow model to estimate the traffic condition. The authors demonstrate an application of the proposed solution in real-time route planning applications. Evaluation results show that the proposed solution outperforms many existing ones in terms of accuracy and efficiency in traffic-aware route planning applications.

4. Applications and Services

To make transportation more efficient and more safe, the paper entitled "Precise Relative Positioning of Vehicles with on-the-Fly Carrier Phase Resolution and Tracking" by F. de Ponte Müller proposed a method to determine the relative position of two vehicles using a cooperative approach. The proposed approach is designed for low-cost single-frequency receivers that are already integrated in modern vehicles. This method has been tested in an open-sky rural environment with two vehicles driving behind each other. It has been demonstrated that the proposed approach is able to track with subcentimeter accuracy the baseline. This method is designed to run in real time and is able to track up to 30 integer ambiguities on a modern notebook.

The paper entitled "Multitasking Planning and Executing of Intelligent Vehicles for Restaurant Service by Networking" by J. Zhang et al. proposed an approach for multitasking in restaurant service of intelligent vehicles by networking. By integrating the plan executing and execution monitoring, the vehicles can work online in dynamic environment. As the vehicles are working in network, the mechanism for cooperating by sharing information and allocating task help the vehicles to handle partially observability and uncertainty in dynamic world. The proposed approach has made obvious progress on improving the efficiency and robustness of the vehicles.

5. Conclusions

All of the above papers either address original research in architectures, algorithms, services, and information fusion methods or propose novel application models in the various intelligent mobility fields. They also trigger further related research and technology improvements in application of connected vehicles services. This special issue serves as a landmark source for education, information, and reference to professors, researchers, and graduate students interested in updating their knowledge about or active in vehicle networking, intelligent mobility, and novel application models for distributed sensor networks.

The guest editors are deeply indebted to numerous reviewers for their professional effort, insight, and hard work put into commenting on the selected articles that reflect the essence of this special issue. We are grateful to all authors for their contributions and for undertaking two-cycle revisions of their manuscripts, without which this special issue could not have been produced. We hope that this special issue will be a good addition to the area of next generation intelligent vehicles networking.

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