Pervasive and Mobile Computing 8 (2012) 165–166

Contents lists available at SciVerse ScienceDirect

Pervasive and Mobile Computing

journal homepage: www.elsevier.com/locate/pmc

Editorial

Vehicular sensing where vehicles gather, process, and share sensor data is emerging as a new network and programming paradigm for sensor information sharing in urban environments. Vehicular sensing will stimulate a brand new family of visionary services for vehicles, from entertainment applications to tourist/advertising information, from driver safety to opportunistic intermittent connectivity and Internet access. Further, smartphones have recently received a lot of attention for their potential as portable vehicular sensing platforms (instead of installing on-board sensors), since they are equipped with a variety of environment and motion sensors (e.g., audio/video, accelerometer, and GPS) and multiple wireless interfaces (e.g., WiFi, Bluetooth, and 3G). The ability to take a smartphone on board a vehicle and to complement the sensors of the latter with advanced smartphone capabilities is of immense interest to the industry.

In general, vehicular sensing represents a significantly novel and challenging deployment scenario, considerably different from more traditional wireless sensor network environments and thus requires innovative solutions. Vehicles usually exhibit constrained mobility patterns due to street layouts, junctions, and speed limitations. Vehicular sensing may interact with stationary road-side base stations or inter-work with existing fixed road side sensors. Vehicular sensing could also scale up to tens of millions of users; for instance, smartphone-based vehicular sensing applications could collect location traces from millions of users behind the wheel. This special section is intended to present recent research developments and efforts on realizing vehicular sensing and its applications in such challenging urban environments. The topics covered in this special section, which are exemplar of the "hottest areas" of current research in the field, include RFID-based accurate localization, urban sensor data gathering, peer-to-peer traffic information systems, and opportunistic parking services.

The first article titled "RFID Assisted Vehicle Positioning in VANETs" by Lee et al. proposes an RFID-assisted localization system that aims to improve the accuracy of GPS via RFIDs installed on the roads. The article is motivated by the fact that recent VANET applications, such as safe driving and emergency rescue, often demand high position accuracy, and yet conventional localization systems, e.g., GPS, hardly meet such accuracy requirements. The proposed system employs the DGPS concept to improve GPS accuracy. A vehicle obtains two different position data, i.e., GPS coordinate from the GPS receiver and accurate physical position via RFID. Then, the vehicle computes GPS error and shares it with neighbors to correct inaccurate GPS coordinates. To evaluate the proposed system, the authors conducted extensive experiments both on a simulator and on a real world test-bed. The simulation results showed that, with the RFID-assisted localization system, vehicles acquire accurate position both on a freeway and in an urban area. The results from the test-bed experiments demonstrated that the proposed system is feasible in the real VANET environment.

The second article titled "Delay-Bounded Data Gathering in Urban Vehicular Sensor Networks" by Palazzi et al. considers a practical sensor data gathering scenario where a stationary base station collects sensor data from nearby vehicles via multi-hop inter-vehicular communications. In particular, the article presents an approach of gathering data from a certain geographic area while satisfying a specific delay bound. The proposed method leverages the time interval during which the query is active in order to make the gathering process efficient, properly alternating data muling and multi-hop forwarding strategies like in delay-bounded routing protocols. Simulation results confirmed that the proposed solution can efficiently gather sensor data and outperforms existing solutions.

The third article titled "Peer-to-Peer Data Structures for Cooperative Traffic Information Systems" by Rybicki et al. considers building a traffic information system using smartphones. The proposed schemes use a peer-to-peer network over the Internet via cellular networks to distribute traffic information among participants. Thanks to cellular communications, their approach avoids the well-known limitations of vehicular ad hoc networking, e.g., incremental deployment and disruption-prone wireless connectivity. Since the data maintained in a cooperative traffic information system has a very specific structure, it is particularly profitable – in terms of bandwidth consumption and latency – to tailor the system to this specific application domain instead of re-using generic peer-to-peer approaches. This realization led the authors to the development of GraphTIS, a peer-to-peer network specifically designed to manage traffic information. The article derives the core mechanisms of GraphTIS, starting with PeerTIS, a standard peer-to-peer system that is based on a modification of this standard DHT, and then presenting GraphTIS, a novel peer-to-peer system that has been specifically designed to support traffic information systems.

1574-1192/$ – see front matter © 2012 Published by Elsevier B.V.
doi:10.1016/j.pmcj.2012.02.002

The fourth article titled ''Opportunistically-assisted Parking Service Discovery: Now It Helps, Now It Doesn't'' by Kokolaki et al. considers an interesting vehicular application that informs drivers of the available parking spots. In particular, the authors considered opportunistically sharing this information via inter-vehicular communications; i.e., as the vehicles move around an area, they opportunistically collect and share with each other information on the location/status of each parking spot they encounter. This strategy is then compared against other strategies, namely a blind search without any assistance, and a centralized approach where a central server allocates parking spots based on the global knowledge of parking space availability. Interestingly, the authors showed that the performance of these strategies varies significantly under different configurations and does not always follow our intuition. This article discusses how each approach modulates the information dissemination process in space/time and resolves the competition for the parking resources. Also, a simple mathematical model is proposed to provide analytical insights into the behavior of the centralized approach.

Finally, we would like to thank all those who made contribution to this special section: the authors who submitted their valuable work, the reviewers who spend their valuable time and efforts to improve the quality of this special section, and the editor-in-chief Dr. Shirazi for his continued support and guidance. We hope that the articles included in this special section provide valuable information on the state-of-the-art research on vehicular sensing and spur further research activities on this challenging, interesting, and promising field, as well as the realization of relevant related industrial applications.

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