# Critical applications in vehicular ad hoc/sensor networks

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Vehicular ad hoc networks (VANETs) have emerged as a promising technology with several applications that may have a deep impact on our society. In the past few years, we have witnessed a tremendous growth in this field, with several new techniques and standards having been proposed with the objective of making it easier and safer to drive and transport passengers. Diverse applications are already available that provide information on traffic conditions, the density of vehicles, duration of traffic lights, among many other variables that allow smarter driving decisions to be taken. Moreover, drivers and passengers can download and upload this information as they travel, with the aid of the Road Side Units (RSUs), some of which are already deployed. RSUs are usually connected to the Internet, and are thus widely available to users and services.

Among various kinds of advancements, today's sophisticated vehicles could be equipped with sensor nodes which could monitor and collect the data in sparse and dense regions. These data could be processed for the benefit of communities of people, for example, health monitoring and diagnostic systems, safety alarms, intelligent transport systems, and environment monitoring. The vehicles during movement, equipped with sensor nodes, can also collect the data from human body and that data can be processed in collaboration with the other vehicles for various medical purposes. In this case, VANETs can also be integrated with Body Sensor Networks.

However, as a new technology emerges, it throws new challenges to the research community. Although many solutions already exist focusing on different target areas, there still remains a need for more efficient solutions which can be used in wide variety of applications. Many industrial and academic institutions have already geared up to provide solutions for the benefit of the community. Moreover, there are many constraints that have to be resolved before providing any standard solution. Some examples of the constraints include; mobility of the nodes, connectivity in sparse and dense regions, failure of nodes, network traffic congestion and interference, etc.

The objective of this special issue was to compile papers on various topics in the fields related to the critical applications of Vehicular ad hoc/sensor networks. With successful dissemination of the call, we received in total 35 high quality submissions from around the globe. Each paper was carefully reviewed by a team of experts in the field. After a two-phase rigorous review process, only five papers among the 35 received submissions were selected for inclusion in this Special Issue. The main contributions of these accepted papers are summarized next.

Guerroumi et al. proposed a new Sink mobile and power management strategy for efficient data dissemination in Wireless Sensor Networks. The authors have described a new power threshold by introducing a sink mobility scheme to balance the network load between sensor nodes. In the

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proposed scheme, the sensor nodes are organized in clusters, and a cluster head is selected for each cluster. The cluster head collects and transmits sensing data using the proposed data dissemination process. In this phase, the sensor sink may move toward any cluster based on its sensing data frequency to minimize energy consumption of sensor nodes. The nearer the nodes are to the fixed sinks, the smaller the energy consumption is, due to the need of relaying large amounts of data. From the performance evaluation of the proposed scheme, the conclusion was reached that the proposed scheme outperforms other existing related approaches.

Malina et al. proposed a new efficient group signature for privacy preservation in VANETs. The authors first analyse the impact of several common attacks like Denial of Service or replay attacks on the efficiency of privacy-preserving security solutions in the vehicular networks. Then a privacy preserving scheme is specified, which is based on the group signatures. A formal security analysis is performed, and experimental validation is provided.

Misra et al. proposed a new strategy that is aware of selfish behavior for target tracking in mobile WiMAX-based Vehicular environments. The authors present a Selfishness Aware Target Tracking algorithm which employs the time difference of arrival measurement data when the target is in Line-of-sight (LOS) with more than three base stations (BSs). When no more than three LOS links between the target and the BSs are available, then the cluster-head which is currently serving the target, activates the three most promising mobile nodes for collecting location information about the target. The results obtained show that the scheme proposed by the authors is effective for target tracking in mobile WiMAX-based vehicular environments.

Ho et al. argue that the robustness of Vehicular networks can be enhanced using virtualization technology. The authors employ virtual routers and virtual links for designing failure resilient VANETs. The proposed scheme was able to retain more than 80 % of the original capacity with only 50 % nodes working in the network. The authors validate the proposed scheme both using simulation and analysis.

Finally, privacy-Aware access control for message exchange in VANETs is presented by Karumanchi et al. This work is the first one of this kind in which a comprehensive framework for access control in VANETs is proposed. The authors present illustrative scenario, details of vehicle attestation and registration procedures, and way of verifying vehicle's location. Alongside presenting their analysis and results, they also talk about policy issues. Overall, this is a good work that combines the advantages of previous

schemes and suggests new directions toward privacy protection in VANET scenarios.

The entire process of preparing this special issue was long and we had to work non-stop. However, thanks must be given to the authors of all submitted papers for their interest in this special issue. We congratulate them on the various relevant research projects they are working on for which some results have already been achieved. Due to the strict review process, we could not accommodate all papers, even if of good quality. A comparative scale has been used to finalize the list of the papers. We are very grateful to all the reviewers, for their careful and timely works. Last but not the least, we are deeply grateful to Prof. Bezalel Gavish (Editor-in-Chief, Telecommunication Systems Journal) for providing us the opportunity to take role as guest editors of this special issue and for all the supports he has provided along the way. We hope the papers in this issue would be beneficial to the research community.

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