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Editorial of the MDPI *JSAN* Special Issue on Wireless Technologies Applied to Connected and Automated Vehicles

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Connectivity and automation are two aspects that, together, will revolutionize the transport system. Automation has received more attention, with a great impact even in the media, thus, appearing to be the focus of change. However, if applied alone, it must rely on the partial information provided by short-range sensors and cannot support coordination between vehicles. With the help of wireless communications, cars and trucks can see connected objects far away or behind an obstacle, obtain advanced route information (congestion, weather), and collaborate with each other to improve efficiency and safety.

Several technologies have been considered to enable the connected vehicle paradigm. Among them, one hypothesis is the widely deployed long-range cellular network (from LTE to 5G and beyond); however, despite continuous improvements, even specifically designed for the automotive sector, it still hardly guarantees ubiquitous coverage and may suffer in crowded areas. A complementary solution is the use of direct communications, which today, mainly target the bands reserved in many countries around 5.9 GHz and will be extended to millimeter waves in the future. These include IEEE 802.11p and the cellular-V2X sidelink.

Although mass deployment has already begun, several problems remain to be solved, including the need for new applications to push deployment, the improvements needed to increase throughput and coverage, and the development of models and simulators that can validate all aspects of the system.

This Special Issue presents five high-quality papers that address some of the open issues. Among them, two look at the applications, one with the goal of improving traffic flow prediction [1] and the other providing a methodology that derives wireless technology requirements from use cases and their application-level needs [2]. The other three focus on the access layer, examining one major technology, namely IEEE 802.11p [3], studying interference in IEEE 802.11p-based vehicle-to-infrastructure (V2I) communications [4] or considering the use of Wi-Fi Direct for vehicle-to-pedestrian (V2P) communications [5].

More specifically, the focus of [1] is on road traffic flow prediction as a fundamental part of intelligent transport systems (ITSs). To this end, the authors develop a new approach that combines the Petri nets model with dynamic estimation of intersection turning movement counts. The proposal is analyzed through simulations using two datasets, demonstrating the superiority of the proposal over reference methods.

In [2], the authors elaborate on the requirements of future V2X applications for cooperative and automated driving, providing a description of the main categories of V2X applications and their representative use cases, which are derived from the European-funded 5GCAR project. The use cases are classified into five major classes, corresponding to cooperative maneuvers, cooperative perception, cooperative safety, intelligent autonomous navigation, and remote driving, examples of which are provided. In addition, a methodology for deriving quantitative communication network requirements from automotive-specific requirements is illustrated.

In [3], an overview of IEEE 802.11p is presented, with a focus on its adoption in ITS. To this aim, the authors recall the protocol stack related to dedicated short-range

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communication (DSRC) and analyze both the MAC and PHY layers, detailing their settings and discussing the comparison with LTE-V2X and its evolution to IEEE 802.11bd.

Vehicle-to-infrastructure communications are discussed in [4], with a focus on the impact of interference. The study is carried out through measurements, using hardware on IEEE 802.11p at different frequencies and transmission powers, exploiting a millisecond-level synchronization mechanism to control the destructive interference due to hidden terminals. The authors also propose application-level time-shifting mechanisms that can substantially mitigate interference, even in very congested scenarios.

Finally, the topic of vehicle-to-pedestrian communications is discussed in [5]. In particular, the authors analyze the use of Wi-Fi Direct for this domain as an alternative to the other technologies specifically designed for V2X. In V2P scenarios, with and without line of sight, with varying vehicle speed, measurements using smartphones were performed in terms of communication range, packet delivery rate, and packet inter-reception time. The results were used to finetune OMNeT++ simulations and extend the study to large-scale scenarios. After observing that Wi-Fi Direct appears to be a viable solution in the presence of line of sight but can be problematic in its absence, a new transmission mode based on beacon stuffing was also evaluated, which mitigates the problem of long connection establishment.

We are confident that these papers will provide interesting insights for researchers working in this field, and we would like to thank the Editor-in-Chief and editorial staff of MDPI *JSAN* for accepting our Special Issue proposal and the kind cooperation, patience, and active engagement.

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