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Editorial

Wireless Sensor Networks for Smart Communications

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In the first edition of the special issue titled "Wireless Sensor Networks for Smart Communications", a total of 22 manuscripts were received and 6 of these were accepted. This issue demonstrated that network congestion, user mobility, and adjacent spectrum interference are the main reasons for the degradation of communication quality in Wireless Sensor Networks (WSNs).

In WSNs, the lifetime of network can be extended by exploiting an optimal routing tree algorithm. Besides, by integrating the subgradient-based congestion-optimal Wi-Fi offload and virtualized congestion-optimal Wi-Fi offload algorithms, we can obtain the optimal offload rate of each Access Point (AP). What is more, by using the Device-to-device (D2D) resource allocation and K-nearest Neighbor (KNN) assisted machine learning algorithms, we can obtain effective spectrum resource allocation schemes, and meanwhile by exploiting the mobile state detection algorithms and training of Artificial Neural Network (ANN) model based on ZigBee nodes, we can estimate the heading directions and locations of mobile users.

This special issue has successfully attracted many interesting original articles discussing the optimization of WSNs for smart communications. For example, L. Wang et al. investigated the problem of inefficient spectrum utilization caused by the spectrum sharing and power interference between different communities as well as used the dynamic game theory to optimize the spectrum resource allocation scheme in D2D communication cellular network. The proposed allocation scheme not only quantifies the impact of D2D transmitter power interference on user data transmission rate, but also quantifies the impact of the social relations between different mobile users on data transmission rate. This scheme comprehensively measures the impact of the two factors above on data transmission rate and meanwhile relies on the Nash equilibrium based utility function to design a resource allocation approach based on resource priority searching, which is then used to optimize spectral efficiency. In a subsequent study, Y. Sun et al. proposed a device-free wireless localization system based on the ANN model and used the ZigBee nodes to construct a hardware platform for the communications between different sensor nodes in WSNs. By setting the variance of RSS data and their corresponding indices as the input and the coordinates of known locations as the output for the ANN model training, a satisfactory localization result without the use of special terminals can be obtained. Subsequently, H. A. Shah et al. reported a strategy of using the spectrum-aware KNN algorithm in Cognitive Radio (CR) networks to enhance spectrum utilization. In training phase, this strategy makes global decision based on the perceptual report generated by each CR user, i.e., sending information or keeping silent. At the same time, the majority decisions of different CR users are merged into global one, which is then returned to each CR user. In addition, at each CR user, according to the comparison between global decision and the actual primary user activity determined by confirmation signal, the sensing classes are formed. Then, in classification phase, by comparing each CR user's current sensing report with the existing sensing class formed in training phase, the distance vector and posterior probability of each perceptual class are calculated to indicate

the presence or absence of primary users. In all, this strategy uses a decision-making combination scheme to infer the reliability of each CR user, which is able to determine sending information or keeping silent based on global decision. In response to the Wi-Fi offloading problem, B. Liu et al. studied the problem of network congestion and user mobility management in smart communications. They proposed a Congestion-optimized Wi-Fi Offload (COWO) algorithm to obtain the optimal offload ratio of Wi-Fi networks, which is considered for the enhancement of network throughput as well as mitigation of network congestion. In addition, they improved the COWO algorithm through equivalent transformation and developed a simple Virtual Congestion-optimal Wi-Fi Offload (VCOWO) algorithm, which can well approximate the optimal result obtained by COWO. Finally, extensive simulation results show that the VCOWO is capable of achieving higher network throughput and lower network congestion compared with the existing state-of-the-art. In terms of user mobility, Z. Deng et al. pointed out three special states of human motion, i.e., random hand movement, change of heading direction, and terminal location variation. The performance of heading direction estimation depends on the discrimination of these three states, which can be well achieved according to the user movement states detection, namely, Rotation Matrix and Principal Component Analysis (RMPCA). Besides, the outlier elimination algorithm is also used to improve the accuracy of heading direction estimation of pedestrian. Finally, P. Cao et al. proposed to use multiple Central Processing Unit (CPU) cores to accelerate the process of constructing the optimal routing tree corresponding to the maximal lifetime of WSNs. The goal of this approach is to break down the lifetime maximization problem into several separate subproblems which can be easily solved on each CPU core at the same time. To achieve this goal, they propose three decomposition algorithms, in which two of them are based on the assumption that routing tree does not involve any cycle and the other one is based on the assumption that any node in routing tree has at most one parent node. According to the numerical testing carried out on an 8-core desktop platform, the proposed approach is verified with faster computation speed compared with the conventional ones using only one CPU core.

Therefore, from our perspective, this special issue brings new insights into the WSNs for smart communications. We hope that this information will be helpful to pave the way for the development of intelligent and cognitive communications with wireless sensors in further study.

Conflicts of Interest

I declare that I and the other guest editors have no conflicts of interest or private agreement with companies.

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