Enabling Technologies for Next-Generation Sensor Networks: Prospects, Issues, Solutions, and Emerging Trends

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尽管在所有方面都取得了显著的进步，传统的无线传感器网络（WSNs）仍然无法克服许多操作挑战，这些挑战阻碍了它们的广泛应用。这主要是由于这些网络在所有级别的内在资源受限（例如，有限的能源、带宽和存储）的性质。最近，研究人员已经设想了将WSNs与其他突出技术（如多机器人网络系统、Cloud和RFID）集成的潜力。这些集成的下一代传感器网络（NSNs）有望引入广泛的新型应用，同时克服这些挑战。例如，机器人辅助WSNs不仅可以满足能源问题，还可以实现自主和智能的环境交互。同样，传感器-云可以提供强大、可扩展的存储和处理基础设施，用于大规模应用。然而，整合/融合这些技术引入了新的问题和挑战，如多机器人任务分配、协作和协调。

这种特别的问题旨在促进高质量的提交，这些提出来的在NSNs中的新近的开发和可能的未来方向。这个问题特别挑选了高质量的论文，来自世界不同部分的作者。然而，只有11篇高质量的论文被提交，通过严格的审稿过程。我们提供以下接受论文的亮点。

P. Khan等人分析了MAC协议在不同访问周期下的性能。他们使用Markov链来开发一个分析模型，以估计性能指标，如能量消耗、归一化吞吐量和平均帧服务时间。他们考虑了IEEE 802.15.6标准中定义的不同用户优先级和访问方法的访问阶段。他们的研究结论是，不必要的独占访问阶段在使用CSMA/CA的WBAN中会降低系统吞吐量，消耗更多的能量，导致较高的延迟。

S. T. Bakhsh等人提出了一种多机器人拓扑变化的分布式MAC协议。这些协议能有效适应动态拓扑变化，而不需要任何同步机制。他们通过模拟结果证明了这些协议的性能优越性。

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To detect anomalies in WSNs, R. Rizwan et al. proposed a bioinspired mechanism using Negative Selection Algorithm (NSA). The proposed NSA employs a detector set containing anomalous packets to identify certain anomalies. Simulations experiments are conducted on a large dataset and high accuracy in detecting anomalies is reported. The paper authored by I. Ahmad proposed a feature selection method based on particle swarm optimization (PSO) for intrusion detection in WSN. The proposed method picks optimal subset of features from the principal space. The performance of the proposed method is validated and compared to GA-based and PCA-based schemes using standard KDD dataset. To investigate the security of SCADA system, A. Shahzad et al. conducted a study to examine the security of DNP3 protocol. They developed a simulation environment employing intelligent connected sensors deployed for water pumping process and security is analyzed inside DNP3 protocol stack. The paper authored by M. Abazeed et al. reviewed the challenges of secure routing in current and next-generation wireless multimedia sensor networks (WMSN). This study comprehensively reviewed critically state-of-the-art routing and security approaches for WMSN along with their features and limitation.

Two distributed mobility management schemes for 6LoWPAN networks are proposed in the paper authored by M. Gohar et al. The proposed schemes implemented home agent, local mobility anchor, and mobile access gateway functions and the handover operations are performed directly between two neighboring 6LoWPAN gateways. The performance of the proposed schemes is shown to outperform contemporary approaches in terms of registration and handover delays. To improve network lifetime and stability, Hybrid Energy Efficient Reactive (HEER) and Multihop HEER (MHEER) protocols are proposed by M. Akbar et al. MHEER designates cluster heads based on maximum energy and variants of both protocols with sink mobility are also proposed. The performance of the proposed schemes is shown to outperform contemporary schemes.

The paper authored by T. R. Sheltami et al. evaluated the performance of two state-of-the-art time synchronization protocols (i.e., Flooding and Recursive Time Synchronization Protocol). For time synchronization in WSN, the former uses broadcast, while peer-to-peer mechanism is used by the latter. Using different topologies, the performance of the two protocols is analyzed based on three metrics, that is, synchronization message count per cycle, bandwidth, and convergence time.

A. Stefanov investigated the distortion performance of multihop underwater acoustic sensor networks (UASN) in his paper. This study evaluates distortion when the sensor-to-sensor links experience Rician fading and there is interference from other sensors in the network. The results of the numerical analysis illustrate the coverage-limited and the interference-limited region. The impact of retransmissions on the distortion performance is also considered.

The paper authored by R. M. Mehmood and H. J. Lee provided a time and frequency domain analysis on EEG data through Brain Sensors Network. They computed the signal regularity to view the emotional conditions (i.e., neutral, sad, happy, calm, and scared). Their study concludes that delta frequency wave has more energy in most cases and it can be used for emotion recognition in real-time EEG systems.

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