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Special issue on Underwater Acoustic Sensor Networks: Emerging Trends and Current Perspectives

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A huge amount of unexploited valuable resources lie hidden in underwater environment which covers around 70% of the Earth. For effective oceanographic data collection, pollution monitoring, resource exploration, disaster prevention, assisted navigation and remote real time surveillance applications [1], underwater sensor networks (UWSNs) which consist of large number of underwater senor nodes are deployed. In order to make these applications viable in this hostile domain, the underwater nodes must be able to coordinate their operation by exchanging configuration, location, and relevant data each other and to an onshore control station [2]. UWSN is highly energy constrained because of limited battery power, limited bandwidth, channel characteristics, propagation delay, multi-path effect, and fading. The UWSN acoustic channel is open and is vulnerabe to malicious activities, particularly for time-critical military applications. Moreover, sensing and communication strategies tend to vary with underwater environments [3]. So, the techniques and protocols should be in accordance with the behaviour and nature of the environment [4]. These challenges demand the exploration of intelligent, energy efficient, secure, and robust UWSN systems.

The specific objective of this special issue is to collect high-quality research articles with solid background in both theoretical and practical aspects of underwater acoustic sensor networks. We received 26 papers and after rigorous review process, 7 papers have been finally selected for this special issue. Various contributions pertaining to the different aspects in the associated fields make this a rendezvous of trending themes that explore research scope. Below given, are the main ideas of each accepted paper:

In [5], authors propose a cross-layer protocol stack for three-dimensional underwater acoustic sensor network. The proposed stack combines the services of physical layer, data link layer and network layer protocols. The stack also provides time-synchronization, clustering and power level management. The protocol stack has been implemented using UnetSim simulator and the performance has been evaluated for various parameters.

In [6], a theoretical framework for performance computation of receiver synchronized TDMA (RS-TDMA) and and transmitter synchronized TDMA (TS-TDMA) in UWSN with a random inter-nodal signal propagation delay and distance dependent propagation delay deviation is presented. The paper provides a detailed analysis and simulation based comparison of results using different parameters. Authors finally conclude that the performance of RS-TDMA is better than that of TS-TDMA for a centralized architecture.

In [7], a new region based cooperative routing protocol for UWSN is presented for network lifetime prolongation and throughput maximization. The proposed scheme determines the trajectories for mobile sinks and employs energy harvesting techniques. Based on simulation results authors conclude that the proposed routing protocol performs better than the existing schemes in terms of throughput and network lifetime.

In [8], an energy efficient chain based routing protocol which divides the network into clusters is presented. The location free communication based on the hop count and confidence level of the nodes is used. The results are compared with channel aware routing protocol (CARP). The proposed routing scheme has decreased the communication cost of sensor nodes and thus achieved increased network lifetime.

In [9], an asymmetric link-based reverse routing method (AREP) has been proposed to address the one-way communication problem caused by asymmetric links in UWSN. The paper explores the impact of underwater nodes' directional beam width on communication links. In order to address the routing void problem, data packets are greedily forwarded to the sink node. The simulation results show that AREP improves the network performances in terms of transmission delay, packet delivery ratio and energy consumption.

In [10], a kind of novel optical-acoustic hybrid underwater wireless sensor network to maximize the advantages of underwater optical communication and acoustic communication is presented. The paper proposes a solution for wireless transmission of real-time video and images in marine exploration and provided new methods for high-speed transmission of marine information detection.

In [11], authors analyze merge conflicts in the processes of communications between maritime vessels and describe the disadvantages of traditional VeMAC protocol on resolving merge conflicts. Finally, the paper proposes a new protocol I-VeMAC which employs a relay node to announce the changes of node information. Thus protocol can be used for transmitting service information among maritime vessels if the density of maritime vessels is high. This reduces the transmission time and improves the transmission efficiency.

In conclusion, this special issue would not have been possible without the help of many people. As Guest Editors we would like to express our deep gratitude to all the authors who have submitted their valuable contributions, and to the numerous and highly qualified anonymous reviewers. We also would like to thank the JNCA Editor-in-Chief and staff for their support during the preparation and production of this special issue.

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