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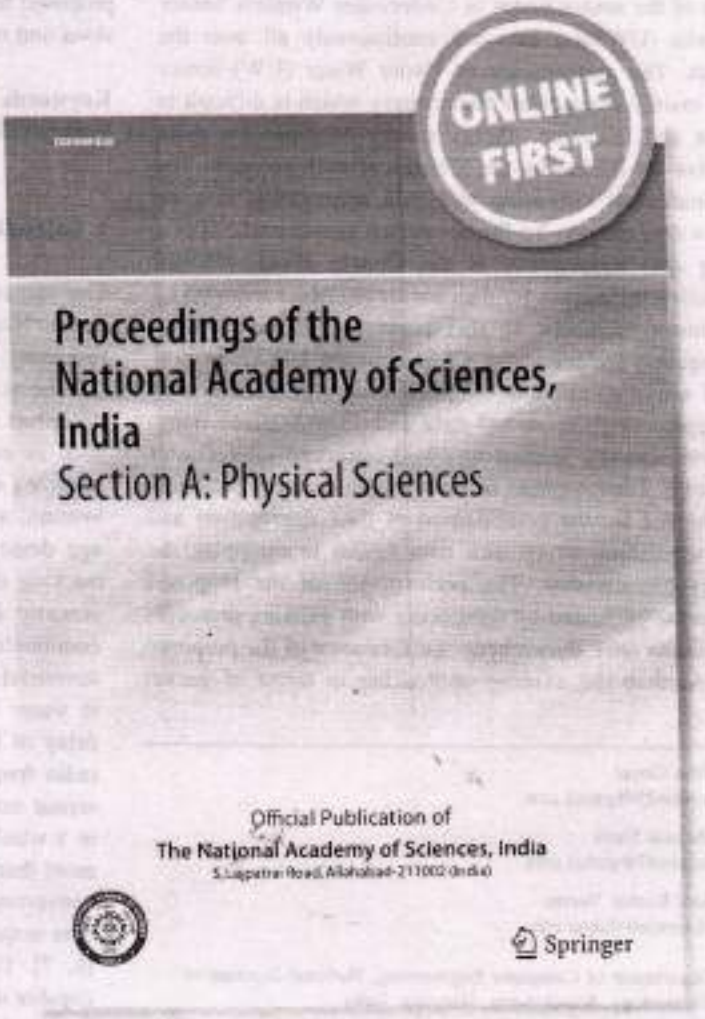

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RESEARCH ARTICLE

Improved Data Aggregation for Cluster Based Underwater Wireless Sensor Networks

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Abstract While performing underwater monitoring tasks, energy of the sensor nodes in Underwater Wireless Sensor Networks (UWSNs) vanishes continuously all over the network. The performance of Under Water (UW) sensor nodes mainly depends on their battery which is difficult to replace and therefore, energy saving becomes the main objective for increasing the lifespan of such network. The combination of clustering and data aggregation may be used to save energy. To further reduce power consumption during data aggregation at the Cluster Head, efficient scheduling techniques for data transmission are required by the cluster members. In this paper, an Improved Data Aggregation technique for Cluster Based UWSN is proposed where an efficient sleep-wake up algorithm is used for aggregating the sensed data and TDMA based transmission schedule is used to avoid intra and inter cluster collisions. Improvement in well-known existing protocols is achieved by the combination of data aggregation and data scheduling along with data fusion to minimize the energy consumption. The performance of the proposed scheme is evaluated by comparing with existing protocols and results have shown better performance of the proposed scheme than the existing approaches in terms of packet drop, end-to-end delay, and energy consumption. The proposed technique also reduces the number of transmissions and efficiently utilizes the UW sensor nodes.

Keywords Clustering · Data aggregation · Energy efficiency · Scheduling · Data fusion

1 Introduction

The successful discussions and studies made on Wireless Sensor Network (WSN) has created the interest towards the research on Underwater Wireless Sensor Networks (UWSNs) especially in last few years. Guo et al. [1] have described the potential of UWSN in various applications such as environmental monitoring, pollution monitoring, undersea explorations, mine reconnaissance, disaster prevention, assisted navigation, nutrient production, oil leakage detection, oceanographic data collection, and target tracking etc. The research in UWSN is significant as the acoustic signals used in UWSN require more power for communication in comparison to the signals used in a terrestrial WSN. The propagation speed of acoustic signals in water is about 1.5×10^3 m/s that causes propagation delay of five orders of magnitude higher than that of the radio frequency (RF) channels [2, 3]. UWSN consists of sensor nodes that are randomly distributed and connected in a wireless fashion inside water. UWSN may consist of more than one sink [4, 5]. Sensors send data to the sink by converting physical parameters into a signal by performing data acquisition, data processing, and data communication [6, 7]. UW Sensors consist of limited memory and are capable of storing small amount of data during monitoring. In the absence of data aggregation scheme, different sensors may independently detect an event from the

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