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RESEARCH ARTICLE

A novel fault detection and recovery technique for cluster-based underwater wireless sensor networks

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Summary

The performance of underwater wireless sensor network gets affected by the working of a cluster in the network. The cluster head (CH) or cluster member (CM) fails because of energy depletion or hardware errors that increase delay and message overhead of the network. To recover the affected cluster, a technique is required to identify the failed CH or CM. We propose a fault detection and recovery technique (FDRT) for a cluster-based network in this paper. Primarily, while selecting the CH, a backup cluster head (BCH) is selected using fuzzy logic technique based on parameters such as node density, residual energy, load, distance to sink, and link quality. Then, failure of CH, BCH, and CM is detected. If fault is detected at CH, then the BCH will start performing the task of failed CH. Simultaneously, when BCH failed, any other CM will be elected as BCH. If any of the CM appears to be non-performing, then CH will detect the communication failure and request BCH to transfer the data from the failed CM to CH. The comparison of proposed FDRT is performed with existing FDRTs EDETA, RCH, and SDMCGC on the basis of packet drop, end-to-end delay, energy consumption, and delivery ratio of data packets. By simulation results, it is shown that FDRT for cluster-based underwater wireless sensor network results in quicker detection of failures and recovery of the network along with the reduction in energy consumption, thereby increasing the lifespan of the network.

KEYWORDS

backup cluster head, cluster head, cluster member, fault detection, fault recovery, UWSN

1 | INTRODUCTION

Underwater wireless sensor network (UWSN) consists of multiple underwater sinks (UW-sinks) situated in the middle of areas under surveillance. Also, there are sensor nodes that surround UW-sink and a surface station linked to control center located on-shore.[1-4] Out of many characteristics of UWSN, narrow bandwidth, time-consuming propagation, and stringent geographical environment of acoustic medium are some characteristics that give challenges for propagation under UWSN.[5,6] These all lead to some serious issues like high bit error rates, temporary losses of connectivity, and limited energy, which in turn make UWSN a difficult medium for data transmission.[7,8] UWSN typically consists of homogenous and quasi-stationary nodes.[9-13]