Available online at www.sciencedirect.com

ScienceDirect

Procedia Computer Science 252 (2025) 985–994

Procedia Computer Science

www.elsevier.com/locate/procedia

4th International Conference on Evolutionary Computing and Mobile Sustainable Networks

An Energy Efficient Hybrid Communication Protocol for Large Area Wireless Sensor Networks

Shreyas Karthigeyan[a], Sampark Bhol[b], Akshat Jain[a], Karthik Yadav[b], Akash Sinha[c], Padma Priya R[b]*

[a]School of Computer Science and Information Systems, Vellore Institute of Technology, Vellore Campus, Vellore, Tamil Nadu 632014, India

[b]School of Computer Science and Engineering, Vellore Institute of Technology, Vellore Campus, Vellore, Tamil Nadu 632014, India

[c]Department of Computer Science and Engineering, Maulana Azad National Institute of Technology Bhopal, Madhya Pradesh 462003, India

Abstract

Energy conservation is an indispensable aspect of the protocols designed for Wireless Sensor Networks (WSNs). The communication protocols for WSN fall mainly under two categories: centralized and distributed. Centralized protocols are not feasible for real-world WSNs as the network can span across large areas where most of the nodes cannot directly communicate with the base station (BS). The routing issues in such networks can be addressed using multi-hop protocols. However, the process of BS guided clustering in such methods cannot be performed. Distributed clustering methods that minimize the intervention of BS in clustering can provide feasible solutions in such cases, but the energy expenditure is considerably high. This paper, hence, proposes a hybrid clustering based routing protocol for large WSN that employs certain aspects of centralized as well as that of distributed protocols. Experimental evaluation of the proposed protocol in terms of network lifetime gives promising results that clearly indicate the energy efficiency and consistency of the proposed work in different scenarios. The proposed work can prove beneficial in real-life scenarios where the deployed nodes are far away from the BS.

Keywords: WSN;Hybrid;Cluster;Multi-Hop;Energy

1. Introduction

WSN comprises of embedded sensors that track environmental and physical conditions and wirelessly send data to a BS [1]. WSNs are used in the military, healthcare, security, and traffic control industries [2][16]. Each cluster head

1877-0509
10.1016/j.procs.2025.01.059