SENSOR NETWORK DEPLOYMENT METHOD USING MULTILEVEL NODE CLUSTERING

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Efficient deployment of sensor nodes is a critical aspect in the design of wireless sensor networks (WSNs), especially for applications requiring long-term autonomous operation. This paper proposes a multilevel node clustering method for sensor network deployment that balances energy consumption, improves coverage, and enhances scalability.

The approach is based on a hierarchical clustering model [1], where nodes are organized into local clusters with designated cluster heads. These cluster heads, in turn, form higher-level clusters in a recursive manner. The deployment algorithm takes into account factors such as node density, residual energy, and inter-node distance to dynamically assign roles and organize the network.

A hybrid metric combining coverage redundancy and communication cost is used to select optimal cluster heads at each level. Simulations performed using MATLAB and OMNeT++ show that the proposed method significantly prolongs network lifetime [2] and reduces energy imbalance compared to traditional single-level clustering approaches such as LEACH or HEED.

The multilevel architecture supports modularity and facilitates localized data aggregation and transmission, which reduces overall communication overhead. The method is especially effective in large-scale and heterogeneous deployment scenarios, where adaptability and hierarchical organization are crucial.

The multilevel node [3] clustering method significantly improves the deployment efficiency of sensor networks by optimizing energy consumption and enhancing coverage. Its hierarchical structure enables better scalability and localized data processing, making it especially effective for large-scale and heterogeneous environments. This approach supports longer network lifetime and more balanced resource usage compared to traditional clustering techniques.

References

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