ABSTRACT

Title: **NODE DEPLOYMENT STRATEGIES USING BIO-INSPIRED ALGORITHMS FOR WIRELESS SENSOR NETWORKS**

Wireless Sensor Networks (WSNs) have become ubiquitous with their diversified and ever-increasing applications. Resource-constrained nature of WSN has triggered widespread research for innovations in resource conservation. Node deployment is an important research area for significant improvement in network performance. The existing methods for node deployment are metaheuristic in nature. They suffer from problems such as stagnation and premature convergence.

However, bio-inspired methods such as Particle Swarm Optimization (PSO), Ant Colony Optimization (ACO) and Moth Flame Optimization (MFO), to mention a few, are found to be significant contributors towards optimal node deployment in sensor networks. These methods do have their shortcomings in terms of making node placement highly optimal. Therefore, this research proposes node deployment strategies by enhancing bio-inspired algorithms to improve the performance of WSNs in terms of coverage, performance and network longevity.

Firstly, a strategy for node deployment is WSN proposed and implemented. The strategy considers two essential metrics in making node placement decisions. They are the number of relay nodes and the cost of movement by relay nodes towards efficient data transmission. An "Intersection Point based Optimal Node Placement (IPONP)" algorithm is defined to realize this node deployment strategy. Secondly, a hybrid bio-inspired algorithm is proposed for leveraging node deployment strategy in WSN. This algorithm is known as Hybrid Modified ACO and PSO (HMAP). It is designed in such a way that it exploits features of two bio-inspired methods, namely PSO and ACO. The former optimizes the positioning of relay nodes through learning strategies, while the latter helps in ideal route discovery and efficient data transmission.Thirdly, a multi-objective-based sensor deployment strategy is proposed by defining an Improved BAT Algorithm (IBA). Different objectives it considers while deploying the nodes optimally include node placement, connectivity, coverage, data transmission, energy and network lifetime. The algorithm has its fitness function to determine bat movement, which influences the outcome of the node deployment strategy. Fourth, a bio-inspired algorithm the "Mutated Moth Flame Optimization algorithm (MUMFO)" is proposed for optimal node deployment in WSN. It is equipped with a novel mutation strategy which strikes a balance between the exploitation capability of MFO and exploration and divides a moth's fitness into three categories good, bad and average. The proposed algorithm overcomes stagnation and premature convergence problems of the existing MFO algorithm. It is designed to be efficient for optimal node deployment in WSN.

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