Enhancing the Lifespan and Energy Efficiency of Wireless Sensor Network Using Clustering and Routing Protocol

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Abstract— Energy efficiency is one of the major parameters in Wireless Sensor Networks. In this paper we attempt for a solution to balance the energy usage for maximizing the network lifetime, increase the packet delivery ratio and throughput. Our proposed algorithm is based on Energy Density of the clusters in Wireless Sensor Networks. The cluster head is selected using two step method and on-demand routing approach to calculate the balanced energy shortest path from source to sink. This unique approach maintains the balanced energy utilization among all nodes by selecting the different cluster heads dynamically. Our simulation results have compared with one of the plain routing scheme (EBRP) and cluster based routing (TSCHS), which shows the significant improvements in minimizing the delay and energy utilization and maximizing the network lifetime and throughput with respect to these works

Key words: Balanced Energy Shortest Path, Cluster, Network Lifetime, Wireless Sensor Network (WSN), cluster head

I. INTRODUCTION

Wireless sensor Networks (WSNs) square measure employed in varied applications like Traffic management, Battle field police work, Environmental observation, Health care systems, underwater applications and etc. Energy utilization is one in all the many parameter for battery powered wireless sensing element networks. It is essential to scale back energy consumption altogether the sensing element nodes to extend the network lifespan. In WSNs, the nodes encompassing the sink have tendency to empty their energy presently compared to the nodes removed from the sink and such irregular energy drain can decrease the network lifespan. Unbalanced energy utilization will cause network partition despite the fact that several of the nodes might have most residual energy that square measure removed from the sink. Thus, it is necessary that each node ought to consume energy equally so as to extend the lifespan of the network. Energy potency and balanced energy utilization square measure completely different aspects. Shortest path routing uses energy with efficiency however might not lead to balanced energy utilization. Topology, Applications and Routing protocols square measure main causes for unbalanced energy utilization. We have designed a cluster primarily based routing protocol to utilize energy with efficiency and effectively among all the nodes terribly very given cluster. The cluster head is chosen supported two parameters (i) the residual energy (ii) energy density of a given node. The energy density of each node relies on the relation of add of the residual energy of the neighbor nodes (including itself) and so distance from the native cluster head and coverage space. On-demand routing is employed through the cluster head to urge the balanced energy shortest path. This approach consumes lower energy and utilizes energy uniformly across all nodes among the complete network resulting in increasing period and output.

II. Related work

Several techniques are analyzed in the various literatures to conserve energy and hence improve network lifetime. J. Luo and J. P. Hubaux [1] says that although many energy efficient/conserving routing protocols have been proposed for wireless sensor networks, the concentration of data traffic towards a small number of base stations remains a major threat to the network lifetime. The main reason is that the sensor nodes located near a base station have to relay data for a large part of the network and thus deplete their batteries very quickly. Y. Xu, J. Heidemann, and D. Estrin [2] proposes a geographical adaptive fidelity(GAF) algorithm that reduces energy consumption in ad hoc wireless networks. This algorithm conserves energy by identifying nodes that are equivalent from a routing perspective and then running off unnecessary nodes, keeping a constant level of routing fidelity. M. Singh and V. Prasanna [3] focus on design of an energy-balanced, energy-optimal algorithm for sorting in a single-hop sensor network. Energy optimality implies that the overall energy dissipation in the system is minimized. R. C. Shah and J. M. Rabaey [4] propose a view that always uses lowest energy paths that may not be optimal from the point of view of network lifetime and long-term connectivity. To optimize these measures, he propose a new scheme called energy aware routing that uses sub-optimal paths occasionally to provide substantial gains. S. J. Baek and G. de Veciana [5] investigates the use of proactive multipath routing to achieve energy-efficient operation of ad hoc wireless networks. The focus is on optimizing tradeoffs between the energy cost of spreading traffic and the improved spatial balance of energy burdens. He propose a simple scheme for multipath routing based on spatial relationships among nodes. Ashok Kumar and Vinod Kumar [6] propose a location based protocol for WSN supporting an energy efficient clustering, cluster head selection/rotation and data routing method to prolong the lifetime of sensor network. Proposed clustering protocol ensures balanced size cluster formation within the sensing field with least number of transmit-receive operations. WANG Jun1, Zhang Xin, et.al [7] proposes a Distance-based Energy Aware Routing (DEAR) algorithm to ensure energy efficiency and energy balancing based on theoretical analysis of different energy and traffic models. During the routing process, author considers individual distance as the primary parameter in order to adjust and equalize the energy consumption among involved sensors. The residual energy is also considered as a secondary factor.
III. PROPOSED SYSTEM

The proposed protocol adopts the high-energy-first technique to pick cluster heads in every spherical to remedy this downside. Once collection knowledge, every device node must send knowledge along with the knowledge concerning its remaining wattage, and so the bottom station will decide that nodes area unit to be elect as cluster heads within the next spherical victimization broadcast messages.

A. Architectural overview

Fig.1 and 2 illustrates proposed protocol Architecture and overall dataflow of the proposed system respectively. The system design is split into 5 totally different phases. Within the 1st section, nodes square measure deployed every which way to form a network. The second section involves cluster formation whereas the third section generates the cluster head supported residual energy and energy density. On-Demand Shortest Path (ODSP) is employed within the fourth section supported the depth calculation. The fifth section represents forwarding the packet from the supply to the sink through the shortest path. The inputs to our system model square measure every which way deployed nodes. Here the cluster head choice section and On-Demand Shortest Path (ODSP) square measure the 2 crucial phases. the subsequent sub section describes the mathematical model and also the totally different modules of the system design.

Clustering: Based on the thrush hold value cluster head is chosen and the nodes nearby to the cluster head join to the cluster.

Coverage Base node Sleep mode: The cluster head collect all packets from the sensor node and sent it to the base station along with the current energy level of the cluster head. According to the energy level the cluster head for the next round of routing is chosen.

Fig.1: Proposed protocol Architecture
Configure: User has to configure the wireless sensor network; he should provide Number of Sensor Nodes, routers and their position to create the network.
Statistics: This module collect the parameters from the simulator, wireless channel module, and calculate the drop packet ratio and performance matrix.
Wireless Sensor Network: This is the wireless sensor network simulator. The nodes are distributed randomly in the network, and a network simulation of the network is done by this module. Nodes can exchange message from one node to another.

Fig.2 illustrates the overall dataflow diagram of the proposed system

IV. SIMULATION AND RESULTS

The simulation is performed on Linux Ubuntu 10.04. The experiments are implemented and run in the network simulator ns-2 (version 2.35). The performance of this protocol discuss with energy efficiency and lifespan. The energy efficiency of the proposed protocol is enhanced compared with an existing protocol. Hence the lifetime of proposed protocol is enhanced.

Fig. 3 shows the comparison of lifetime rounds vs. No. of nodes for the proposed and existing Leech protocol. Lifetime in proposed protocol is maximum compared to existing protocol. The Red line in the graph indicates the lifetime of leech protocol. Green line in the graph indicates the lifetime of proposed protocol.
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V. CONCLUSION

Balanced energy utilization is one of every of the necessary parameters in increasing the time period of the WSNs. Cluster head choice and on-demand routing are 2 vital problems. The planned algorithmic program EDOCR shows that the cluster head choice supported the energy density and also the residual energy is a lot of economical and effective than alternative parameters. we've got followed a novel energy density calculation, supported the parameters like average residual energy of neighbor nodes and itself, distance from native cluster head and coverage space of every node. Such a technique of cluster head choice supports balanced energy utilization and increase in throughout of the network. The shortest path calculation relies on On-Demand approach that considers depth parameter from supply to sink. The accumulative potency of the 2 steps cluster head choice as well as shortest path On-Demand routing has accrued the network time period. It is clearly ascertained that our algorithmic program performs higher than earlier algorithms with relevance uniform utilization of energy, lifetime, packet delivery magnitude relation and output. This work will be extended to mobile sinks to cut back latency and additionally increase the time period of the network.

VI. REFERENCES