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Master Cluster Head and Vice Cluster Head Algorithm for Wireless Sensor Networks Using PSO

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ABSTRACT: One of the most significant strategy measures of wireless sensor networks (WSNs) is energy efficiency. Grouping affords an effective way for encompassing the lifetime of the network. We offer a double cluster-heading clustering algorithm using particle swarm optimization (PSO-DH). The algorithm computes two cluster skulls. The determination of the dominant cluster and the immorality cluster-head needs consider the state information, including position and energy reservation about nodes and their neighbors. Because every node contains a list of information about his neighbors and location using connected dominating set. The dominant cluster head (DCH) receives and masses data to analyst directly. The algorithm poises the energy consumption, so it can encompass the network life time effectively.

KEYWORDS: clustering; sensor networks; PSO; LEACH; energy efficiency.

1 INTRODUCTION

A wireless ad hoc network consist of several number of mobile nodes that communicate one another without require any infrastructure or central management. WSNs are functional in many applications [1]. Sensor nodes are, usually spread in locations for real-time monitor. So energy restraint is the vital tricky of the WSNs. Clustering is one of the energy-efficient techniques [2] for encompassing the lifetime of a sensor network. It is often together with data collection to extend the network lifetime. Some clustering algorithms have been proposed for sensor networks. One of the well-known clustering protocols called LEACH has been introduced in Energy-efficient statement protocol for wireless micro sensor networks. LEACH is a cluster-based protocol that includes spread cluster formation in which the nodes elect themselves as cluster heads with some probability. The algorithm is run occasionally and the possibility of becoming a cluster head for each period is chosen to ensure that every node become a cluster head at least once within I/P rounds, where P is the prearranged ratio of cluster heads, LEACH systematizes its operation into rounds, where each round consists of a setup phase where clusters are formed and a steady state phase that consists of data announcement process. LEACH provides important energy savings and lengthy network lifetime over conventional multi-hop routing schemes. In HEED, the initial probability for each sensor to become a cluster head is reliant on its residual energy [3]. Later, sensors that are not enclosed by any cluster heads double their likelihood of becoming a cluster head. This procedure iterates until all sensors are covered by at least one head. In the concluding stage, sensors join cluster heads that have the lowest cost within their range. The particle swarm optimization (PSO) is a humble, active, and computationally effective optimization algorithm. It has been, practical to speech WSN issues such as optimal placement, node localization, gathering, and data combination. The application of PSO algorithm to solve the

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problem of sensor network clustering has been planned before in “Cluster-head identification in ad hoc sensor networks using particle group optimization” , The authors tried to equalize the number of nodes and candidate cluster heads in each cluster in order to-minimize the energy expended by the nodes- However, no comparison with other clustering protocols in terms of energy efficiency has been addressed in “Cluster-head identification in ad £hoc sensor networks using particle swarm optimization”. In [Energy-aware clustering for wireless sensor networks using particle swarm optimization], a protocol using PSO has been proposed. It has the objective of minimizing the intra-cluster distance and optimizing the energy consumption of £he network. In [Optimization of cluster-based routing protocols in wireless sensor network using PSO], a new cluster-based algorithm using PSO is proposed. The election of cluster-heads needs to consider the information of location and energy reserved about candidates and their neighbors. Based on this remark, this paper suggests a double cluster-heads clustering algorithm using the particle swarm optimization (PSO-DH), In the basis of LEACH, the algorithm creates two cluster heads using PSO. It not only considers the cluster-head Optimized selection, but also considers nodes energy symmetry. The intra-cluster data transmissions begin after clusters have been formed. The Chief Cluster Head (MCH) receives and totals the data from its cluster members. The combination data are sent to the vice one. The Vice Cluster Head (VCH) transmits combination data to the sink directly. MCH is not direct message with the sink, which can save energy. The mechanism better balances the network workloads, and clearly prolongs the lifetime of a sensor network.

2 PROTOCOL SPECIFICATION

We suggests a double cluster-heads clustering algorithm using the particle swarm optimization (PSO-DH), in the basis of LEACH, the algorithm generates two cluster heads using PSO. It not only considers the cluster-head Optimized selection, but also considers node' energy equilibrium. The intra-cluster data transmissions begin after clusters have been formed. The Master Cluster Head (MCH) receives and aggregates the data from its cluster members. The aggregation data are sent to the vice one. The Vice Cluster Head (VCH) transmits aggregation data to the sink directly. MCH is not direct communication with the sink, which can save energy. The mechanism better balances the network workloads, and clearly prolongs the lifetime of a sensor network. . We use multi-hop routing among the VCHs because the less time sequence between the member node and head.

Particle Swarm Optimization (PSO):

The particle swarm optimization (PSO) is a computational method that optimizes a problem by iteratively trying to improve a member of set. PSO optimizes a problem by having a population of candidate solution. PSO is originally attributed to **Kennedy and Eberhart**. The movement of organisms in a bird flock [8]. The algorithm was simplified and it was observed to be performing optimization.PSO is a met heuristic as it makes few or no assumptions about the problem being optimized and can search very large spaces of particles. The particle swarm optimization (PSO) is a humble, active, and computationally effective optimization algorithm. It has been, practical to speech WSN issues such as optimal placement, node localization, gathering, and data combination. The application of PSO algorithm to solve the problem of sensor network clustering has been planned before in “Cluster-head identification in ad hoc sensor networks using particle group optimization” , The authors tried to equalize the number of nodes and candidate cluster heads in each cluster in order to-minimize the energy expended by the nodes- However, no comparison with other clustering protocols in terms of energy efficiency has been addressed in “Cluster-head identification in ad £hoc sensor networks using particle swarm optimization”.

LEACH protocol

One of the well-known clustering protocols called LEACH has been introduced in Energy-efficient statement protocol for wireless micro sensor networks. LEACH stands for Low-Energy Adaptive Clustering Hierarchy. LEACH is a cluster-based protocol that includes spread cluster formation in which the nodes elect themselves as cluster heads with some probability. The algorithm is run occasionally and the possibility of becoming a cluster head for each period is chosen to ensure that every node become a cluster head at least once within I/P rounds, where P is the prearranged ratio of cluster heads, LEACH systematizes its operation into rounds, where each round consists of a setup phase where clusters are formed and a steady state phase that consists of data announcement process. LEACH provides important energy savings and lengthy network lifetime over conventional multi-hop routing schemes. This WSN is considered to be a dynamic clustering method. LEACH has two phases .The reason we need network protocol such as LEACH is due to the fact that a node in the network is no longer useful when its battery dies. This protocol allows us to space out the lifespan of the nodes, allowing it to do only the minimum work it needs to transmit data. The LEACH Network is made up of nodes, some of which are called *cluster-heads* The job of the cluster-head is to collect data from their surrounding nodes and pass it on to the base station LEACH is *dynamic* because the job of cluster-head rotates This is the formula for the amount of energy depletion by data transfer: LEACH’s Two Phases The LEACH network has two phases: the set-up phase and the steady-state

- The Set-Up Phase
    - Where cluster-heads are chosen
- The Steady-State
    - The cluster-head is maintained
    - When data is transmitted between nodes

It is Stochastic Threshold Algorithm. Cluster-heads can be chosen stochastically (randomly based) on this algorithm:

If n < T(n), then that node becomes a cluster-head.

The algorithm is designed so that each node becomes a cluster-head at least once. Deterministic Threshold Algorithm .A modified version of this protocol is known as LEACH-C (or LEACH Centralized)This version has a deterministic threshold algorithm, which takes into account the amount of energy in the node…Deterministic Threshold Algorithm and/or whether or not the node was recently a cluster-head. The changes between the LEACH stochastic algorithm and the LEACH-C deterministic algorithm alone is proven to increase the FND (First Node Dies) lifetime by 30% and the HND (Half Node Dies) lifetime by 20%

An Example of a LEACH Network:

While neither of these diagrams is the optimum scenario, the second is better because the cluster-heads are spaced out and the network is more properly sectioned.

Multi-Hop:

All the sensor nodes are identical in terms of battery energy and hardware complexity. In clustering, it is evident that the CH nodes will be over-loaded with the long-range communication to the **Base Station (BS)** or **Cluster Head (CH).**This means extra processing is necessary for data aggregation which results in the CH nodes expiring before other nodes, although it is desirable to ensure that all the nodes run out of their battery at about the same time. One important way to ensure this is to rotate the role of a CH among over all the sensor nodes as proposed in Low-Energy Adaptive Clustering Hierarchy (LEACH) and Hybrid Energy-Efficient Distributed Clustering (HEED).We propose Multi-Hop Data Communication Algorithm (MDCA) to evaluate the performance of heterogeneous WSN's. Each Sensor node transmits sensing data to the Base Station (BS) through a Cluster Head (CH).The CHs are selected periodically by different weighted probability. After the selection of CHs, member nodes communicate with their respective CHs by using multi-hop communication. The CHs collect the data from the member nodes in their respective clusters, aggregate the received data, and send it to the BS using multi-hop communication.

3 RELATED WORKS

Distributed Clustering in Ad hoc Sensor Networks: A Hybrid, Energy-Efficient Approach

Prolonged network lifetime, scalability, and load balancing are important requirements for many ad-hoc sensor network applications. Group of sensor nodes is an operative technique for achieving these goals. In this work, we propose a new energy-efficient advance for clustering nodes in ad-hoc sensor networks. Based on this advance, we present a protocol, HEED (hybrid energy-efficient distributed clustering) [3] that periodically select cluster heads according to a hybrid of their balance energy and a secondary guideline, such as node proximity to its neighbors or node degree. HEED does not make any supposition about the instance or quality of nodes. The clustering process complete in O (1) iterations, and does not trust on the network topology. The code of behaviors incurs low overhead in terms of processing cycles and messages interchange. It also achieves fairly different cluster head distribution. A caution selection of the secondary clustering guidelines can settle load among cluster heads.

Cluster-head identification in ad hoc sensor networks using particle swarm optimization

A new optimization system known as particle swarm optimization (PSO).The PSO approach is an evolutionary programming technique where a 'swarm' of test solutions, analogous to a natural swarm of bees, ants or termites, is allowed to interact and cooperate to find the best solution to the given problem[3]. It is a computational method that optimizes a problem by iteratively trying to improve a member of set. Function is used as a criterion for the optimization.

Particle Swarm Optimization

An idea for the optimization of small functions using particle swarm optimization is introduced [9]. The development of various paradigms is object, and an instrument of one of the paradigms is examined. Benchmark experiments of the paradigm are detailed and including small function optimization are proposed.

Energy-Efficient Communication Protocol for Wireless Micro sensor Networks

Wireless divide micro sensor systems will signal the trustworthy monitoring of a change of conditions for both refine and military applications. Based on our findings that the gathering protocols of direct conveyance, minimum-conveyance-energy, multi-hop routing may not be optimal for sensor networks, we nominate LEACH (Low-Energy Adaptive Clustering Hierarchy), a clustering-based protocol that use arbitrary rotation of local cluster-heads to smoothly divide the energy load surrounded by the sensors in the network. LEACH uses limited coordination to operate scalability and strong for energetic networks, and include the data mixing into the routing protocol to minimize the quantity of knowledge that must be pass to the base station.

Improving on LEACH Protocol of Wireless Sensor Networks Using Fuzzy Logic

The Wireless Sensor Networks (WSN) contains an extensive number of sensor nodes that are restriction in energy, processing power and storage. The effective force of nodes is the most valuable thought among them because the lifelong of Wireless Sensor Networks is boundary by the energy of the nodes. LEACH is one of the most celebrated groups of object mechanisms; it chooses a cluster head (CH) based on a likelihood model. It improves LEACH protocol using Fuzzy Logic (LEACH-FL), which takes battery level and node density into consideration.

4 IMPLEMENTATION

- Master Cluster Head
- Energy consumption
- LEACH
- Particle Swarm Optimization

Master Cluster Head

The algorithm is run periodically and the probability of becoming a cluster head for each period is chosen to ensure that every node become a cluster head at least once within ***I/P*** rounds, where P is the predetermined percentage of cluster heads, LEACH organizes its operation into rounds, where each round consists of a setup phase where clusters are formed and a steady state phase that consists of 'he data communication process. Clustering genert.es a master cluster-head and a vice cluster-head. This is followed by a steady state phase in which the data sensed are transmitted to the sink. The master^ cluster-head is -used for the date collecting and date aggregation

Energy consumption:

The transmitter dissipates energy, to run the radio electronics and the power amplifier, and the receiver dissipates energy to run the radio electronics. The radios can perform power control and hence use the minimum energy required to reach the intended recipients. We adopt a typical energy consumption model whose specific details. The energy spent for transmission

LEACH

A double cluster-heads clustering algorithm using the particle swarm optimization (PSO-DH), in the basis of LEACH, the algorithm generates two cluster heads using PSO. LEACH is a cluster-based protocol that includes distributed cluster formation in which the nodes elect themselves as cluster heads with some probability.

Particle Swarm Optimization:

The particle swarm optimization (PSO) is a computational method that optimizes a problem by iteratively trying to improve a member of set. PSO optimizes a problem by having a population of candidate solution. The movement of organisms in a bird flock. The algorithm was simplified and it was observed to be performing optimization.PSO is a met heuristic as it makes few or no assumptions about the problem being optimized and can search very large spaces of particles.

The particle swarm optimization (PSO) is a humble, active, and computationally effective optimization algorithm. It has been, practical to speech WSN issues such as optimal placement, node localization, gathering, and data combination. The application of PSO algorithm to solve the problem of sensor network clustering has been planned before in "Cluster-head identification in ad hoc sensor networks using particle group optimization" , The authors tried to equalize the number of nodes and candidate cluster heads in each cluster in order to-minimize the energy expended by the nodes- However, no comparison with other clustering protocols in terms of energy efficiency has been addressed in "Cluster-head identification in ad £hoc sensor networks using particle swarm optimization".

5 ALGORITHM

PSO ALGORITHM

PSO algorithm works by having a population of particles. These particles are moved around in the search-space according to a few simple formulas. The movements of the particle are guided by their own best position [8]. When improved positions are being discovered these will them come to guide the movement of swarm. Each particle knows best position V_{bd} and global best position V_{gd} are the entre group of paricles The particles will have velocities, which direct the flying of the candidate solution. The velocity and position equation are ollow us

$$V_{bd}(t+1) = WV_{bd}(t) + c1\alpha(P_{bd-X_{ld}(t))+} c2\beta(P_{gd-X_{gd}(t))}$$

$$V_{bd}(t+1) = X_{bd(t)+V_{bd}(t+1)}$$

Where, V- velocity
X- Position
t- Time
c1 & c2- learning factors
α and β – random number
W- Weight

PSO-DH *ALGORITHM*:

PSO-DH Algorithm is same to LEACH. This algorithm first is placed similar object using LEACH. Each object optimally selects the MCH and VCH using PSO [8]. The intra-object data communication to start after clusters has been created. Each MCH accept and mixture the data from its cluster associate. Many objects have to propose the use of TDMA listed in the MAC layer. The mixture dates are sent to the VCH. The VCH transmits mixture data to sink directly.

- We initial similar object using LEACH algorithms. All associate nodes transmit information about its present vigor and actual places.
- The Cluster head moves this algorithm to choose the MCH and VCH using PSO.

6 SIMULATION RESULT

In this concept, we calculate the presentation of PSO-DH algorithm. Pretence test are carried out in the NS2 (Network Simulator 2). We ran the simulation for 250 nodes in network area with same initial energy. The presentation of our algorithm was contrast with the clustering protocols for WSNs. LEACH and PSO-DH contrast their lifetime and energy respectively using multi-hop routing among VSHs. Thus the energy to use all nodes for communication can be minimizing since the distance between member node to cluster head are shorter. LEACH and lifetime of PSO-DH to spread nearly 50% to one of PSO-LEACH.

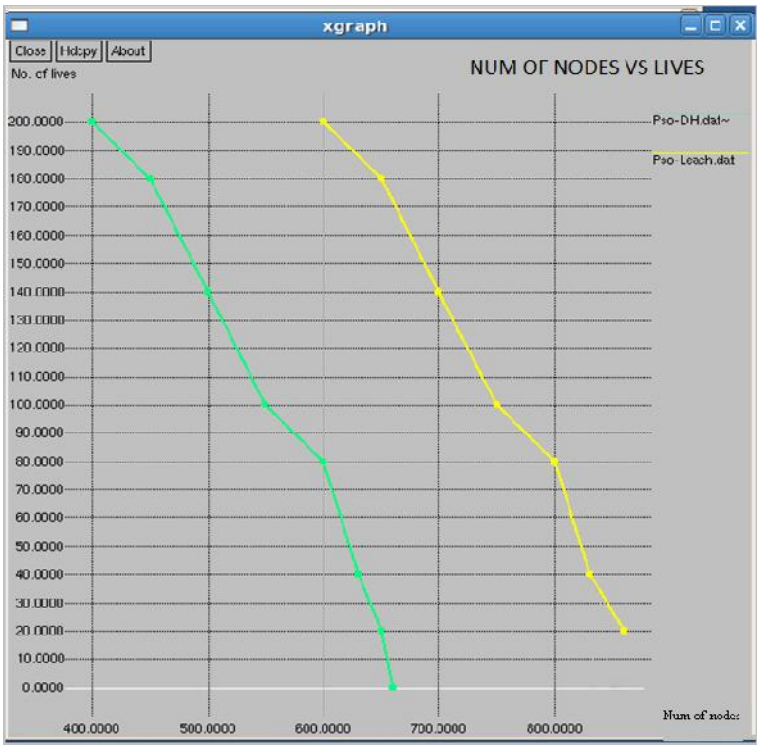

Fig. 1. Num of Nodes vs lives

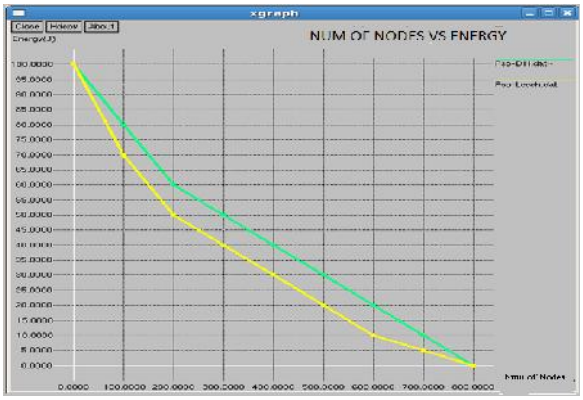

Fig. 2. Num of Nodes vs Energy

7 CONCLUSION

In this Concept, we shows double cluster-heads clustering algorithm using particle swarm optimization algorithm. We have clear a few suitability occupations that take into account the minimum distance between the member node and its bunch head, and the residual energy of the node in the cluster-head assortment algorithm. For balancing the network work load, we adapt the dual cluster head strategy and result shows proposed algorithm poises the energy consumption and extends the network lifetime very effectively. We use multi-hop routing among the VCHs because the less time sequence between the member node and head.

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