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Improved Particle swarm optimization based hierarchal clustering and compressed forwarding for WSN

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Abstract
Wireless Sensor Networks are networks that consist of sensors which are distributed in an ad hoc manner. These sensors work with each other to sense some physical phenomenon and then the information gathered is processed to get relevant results. Data aggregation at the base station by individual nodes causes flooding of the data which consequences in maximum energy consumption. To diminish this problem a new data aggregation technique has been proposed called distributed similarity based clustering and compressed forwarding which has improved the performance of the WSNs by using the group based data aggregation. So in order to remove these issues two new approaches has been proposed in this work. Principle improvement has been done by using the Particle swarm optimization search based optimization technique for energy efficient routing algorithm. By using PSO technique for improvement in efficient energy routing protocol and furthermore, to increases the performance with the use of the compressive sensing by run length coding also. The actual compressive sensing works by using data fusion to eliminate unnecessary information from sensor nodes. Therefore, proposed technique has improved the energy conservation rate further.

Keywords
Clustering , Compressing sensing , PSO, NEACH

I. Introduction

Wireless Sensor Networks (WSNs) can be defined as a self-arranged and connectionless wireless networks toward observe objective or ecological situation such as high temperature, noise, pulsation strain, action or pollutant toward considerately get ahead of their statistics during the network to a most important position otherwise sink wherever data be able to experimental and analyse. In WSNs, the major task of a sensor node is to intellect the information and sends it to base station into multi-hop situation on behalf of which routing trail is crucial. Sensor node be able to communicate along with them use radio signal.

(i). Clustering

Clustering technique is one of the well-liked mechanisms in which nodes decide on a Cluster Head (CH) for communication. All nodes spread their data to CH, where, it collective data and send to the Base Station (BS). Only few nodes are used to spread at large distance so, less energy is consumed. The main idea of clustering is to decrease the network traffic from node to base station. Nodes have limited battery life so to protect energy clustering technique was introduced; in which out of thousands of nodes few nodes turn into cluster head and they control the entire network. Cluster head is a node which is dependable for maintain cluster, collect data from nodes in the cluster and communicate with sink. By using clustering method it has been observed that there is huge quantity of energy that has been saved.

In static clustering technique some policy were followed to select a cluster head, once a cluster is produced and cluster head is selected, the cluster was statically operated until the head node dead. Because cluster head node have more task so rapid decrease in power in the Cluster head node. The loss time was head node was too timely in static clustering technique. It is useful in achieving energy efficiency. It is a key technique used to optimize energy consumption in WSN.

In the usual hierarchical routing protocols cluster-heads (CHs) are chosen according to the contrast between a random numbers generate by sensor nodes and a definite threshold. These CHs have the responsibilities of collect and Aggregate the data from their respective clusters and transmitting them to the Base Station (BS). The aggregation of the data at CHs greatly reduces the energy conservation in the network by minimizing the total data messages transmitted to the BS. Also, the CHs act as local sink for the data, so that the data is transmitted relatively over a short distance. Due to the lack of unnecessary energy conservation caused by the numerous choosing for cluster-heads among sensor nodes and the fact that unfair choosing formula causes uneven energy distribution.

Clustering can be done in 2 types of networks: it can be of two types that is homogeneous and heterogeneous networks. In homogeneous networks, initial energy of all nodes is same while in heterogeneous network, all nodes have different initial energy.

(ii). Compressed Sensing

In WSNs, core purpose of compression is to diminish the power consumption. Sensing testing, calculation, with correspondence is the three procedures, which are generally in charge of the energy expenditure within WSNs. So some system that straight otherwise ultimately reduce individual otherwise additional of the functions even as maintain some necessities (e. g. preconception, difficulty, etc.) be able to measured as compression in WSNs. Compressed realizing (CS) algorithm is an additional perspective into transmission processing especially in favour of information acquisition compressed sensing is an beneficial at whatever point transmission is light in a known basis, dimension is expensive, and count quantity at the authority end is reserved.

LZW compress ( )

I. Enter all letters in table
II. Initialize string s to first letter of input
III. While any input left
IV. Read character c
V. If s+c is in the table
VI. s=s+c
VII. Else output codeword(s)
VIII. Enter s+c in the table

IX. s=c
X. Output codeword(s)

(iii). Particle Swarm Optimization Algorithm

The idea of PSO emerged from the swarming behavior of flock of birds, swarm of bees, schools of fish etc. İt is applied to solve different function optimization problems. İn PSO, the solutions are named particles that travel in the problem space. They follow the present optimum particles. The coordinates of each particle in the problem space are tracked by the particle. They are associated with the best solution achieved up to now and the value is known as pbest. Another best value, lbest, is the best value attained by any particle in the neighbourhood of the particle. Global best value, gbest, is obtained when a particle takes all the population as its neighbours.

I. For each particle
II. Initialise particle
III. End for
IV. For each particle
V. Evaluate the value of fitness
VI. if the fitness value is better than the best value
VII. set current value as pbest
VIII. End
IX. select the particle with best fitness value as gbest
X. For each particle
XI. evaluate particle velocity
XII. update particle position
XIII. End
XIV. while maximum iterations or minimum error condition is not achieved.

II. Related Work

(i). Proposed Algorithm

Step 1: Initialize network.
Step 2: organize network at random within predefined sensor field.
Step 3: Be appropriate NEAHC toward estimate points.
When all nodes receive packet, will calculate their own energy-level (EL) by function:

EL1' (i) = [Remaining energy(i_o)/α] (1)

Step 4: Apply clustering toward develop cluster heads.
Node develop into CH in favor of current rotation about but number with a reduction of subsequent threshold.

$$T(i)=\begin{cases} T_n=\begin{cases}\frac{P}{1-P\left[r \bmod \left(\frac{1}{P}\right)\right]} & ;j \in K \\ 0 \quad \text{otherwise}\end{cases} \end{cases} \quad (2)$$

Where p1 is best for percentage of CHs within each round r' is current node and stand used each node wants to become CH round. $G1'$ is set nodes with the intention of comprise not firefly n selected as CHs in previous i/P rounds.

Step 5: Relate particle swarm optimization on clusters toward discover finest route with CHs to sink.

$$x'(i_0) = x_j'(i_0) \pm r(x'_j(i_0) - x'_k(i_0))$$

Assigning in use PSO to the victuals source:

$$x'(i_0) = x_i'(i_0) \pm r(x'_i(i_0) - x'_k(i_0)) \quad (3)$$

Association of spectator ended via following equations:
Possibility of selecting nectar source:

$$p''_i = \frac{F'(\theta_i)}{\sum_{k1'=1}^{S''} F'(\theta_{k1'})} \quad (4)$$

$p'_i(\theta_i)$:The possibility of select ith engaged firefly
$p'_i(\theta_i)$: The number of employed fireflies
$p'_i(\theta_i)$: The position of the i[th] in use firefly
$p'_i(\theta_i)$: The strength rate

Calculation the new site:

$$x_{i'j'}(t1'+1) = \theta_{ij}(t1') + \emptyset(\theta_{ij}(t1') - \theta_{kj}(t1')) \quad (5)$$

x_i =The position of spectator firefly
T1: Iteration number
θ_k Randomly selected in use particles
Evaluate the velocity of particles by

$$v = \frac{\partial \delta}{\partial t}$$

J1 : Dimension of explanation
$\emptyset(\theta_{i'j'}(t1) - \theta_{k1'j'}(t1))$:A series of random variable in the range .

- Association of the explore particles

Movement of explore particles follows equation

$$\theta_{i'j'} = \theta_{j'min} + r.(\theta_{j'max} - \theta_{j'min}) \quad (6)$$

r 1: Accidental quantity and r1 ∈ [0,1]
Step 6: Evaluate and update energy consumption.

$$d1'_{to\ CH} = \frac{M1}{\sqrt{2\pi k1}},\ d'_{toBS} = 0.765\ \frac{M1}{2} \quad (7)$$

$$E_{tx1}(l'', d1') = \begin{cases} l''E_{elec1} + l''\varepsilon_{fs} & d1''^2;\ d1'' < d1''_0 \\ l''E_{elec1} + l''\varepsilon_{mp} & d1''^2;\ d1'' \geq d1''_0 \end{cases} \quad (8)$$

Where

$$d1_o = \sqrt{\frac{E_{fs1}}{E_{mp1}}} \quad (9)$$

M is area of WSN

E_{fs1} is magnification power of liberated space

E_{mp1} is augmentation power while region is extra.
Step 7: confirm whether every nodes turn into dead, condition yes subsequently illustrate network life span with come again as well maintain to step 3.

$$Dead = \begin{cases} 1 & \text{if } s(i).Energy \leq 0 \\ 0 & \text{otherwise} \end{cases} \quad (10)$$

$$Termination' = \begin{cases} 1 & \text{if } countdead1 == n1 \\ 0 & \text{otherwise} \end{cases}$$

(ii). Proposed Methodology

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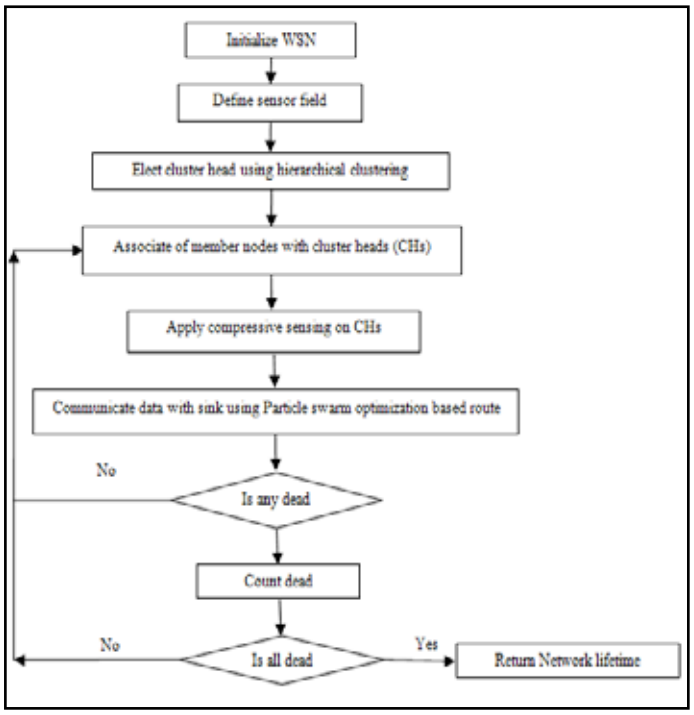

Fig. 1: Proposed flow chart

III. Result and Discussion

The proposed algorithm will be considered from the energy enhancement with firefly algorithm using NEAHC protocol applying dissimilar constraint including first node dead, Network lifespan, Packets sent to base station , remaining energy , packet sent to cluster head, data delivery packet. The subsequent data demonstrates the comparison regarding response to diverse parameters. The result demonstrates the proposed solution provides improvement over active approaches.

Parameter	Value
Area	10 * 100
Base Station	50 * 150
Sink	50*150
Node	200
Probability	0.1
Initial Energy	0.01
Transmitter _energy	50
Receiver _energy	50
Massage size	4000
Fraction of Advance node	0.3
Data aggregation energy	5
Amplification energy	0.0013
Sleeping percentage of (CM)	10
Maximum lifespan	4000
No of round	5000

1. FIRST NODE DEAD TIME (STABLE PERIOD EVALUATION)

Figure shows the comparison among Existing NEACH protocol, proposed PSO using compressed sensing with respect to first node dead time. Bar graph clearly shows that the number of rounds for the first node dead in case of the proposed PSO with NEAHC is more than the Existing NEAHC It is confirmed that the proposed algorithm is comparatively better than the existing techniques. comparatively better than the existing techniques.

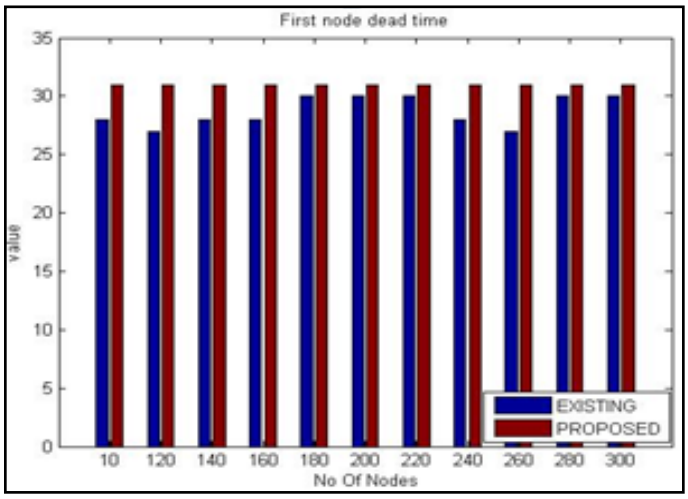

Fig. 2: first node dead time

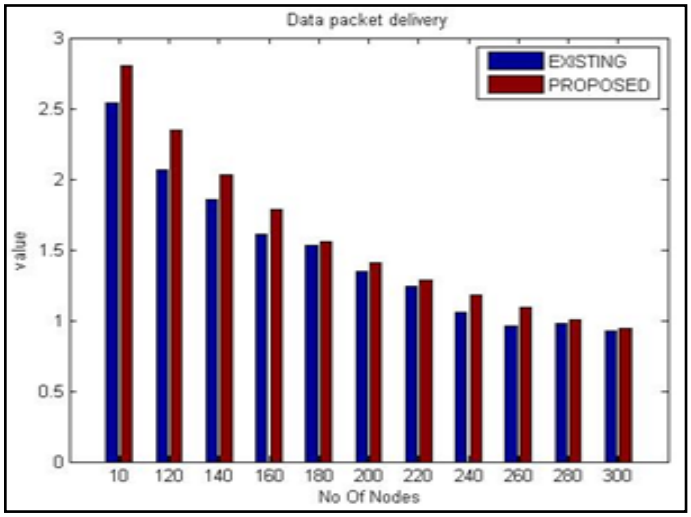

Fig. 3: Data Packet Delivery

Bar graph clearly shows that the number of rounds for the data packet delivery in case of the proposed PSO with NEAHC is more than the Existing NEAHC.

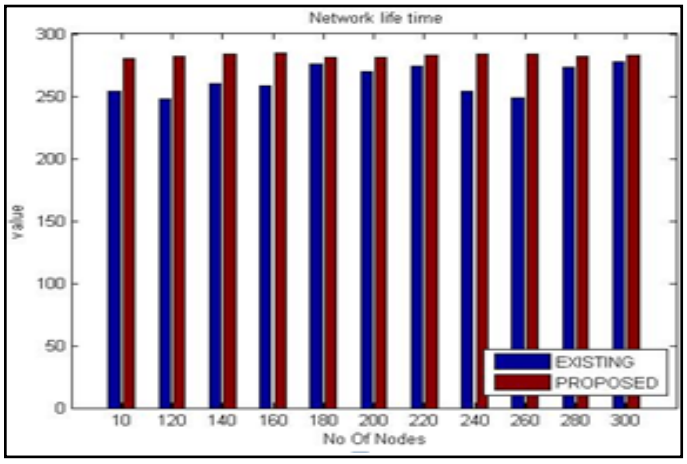

Fig. 4: Network lifetime

Bar graph clearly shows that the number of rounds for the Network lifetime in case of the proposed PSO with NEAHC is more than the Existing NEAHC

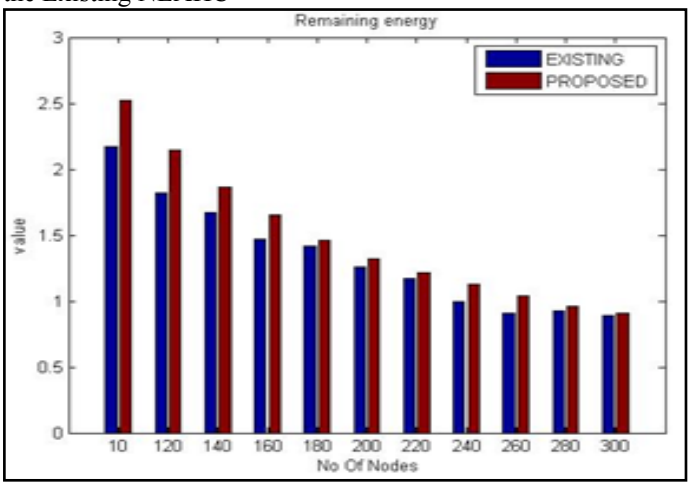

Fig. 5: Remaining Energy

Bar graph clearly shows that the number of rounds for the residual energy in case of the proposed PSO with NEAHC is more than the Existing NEAHC.

IV. Conclusion

In this paper, we have analyzed existing 'Energy aware hierarchical cluster-based routing protocol for WSNs'. The proposed Particle swarm optimization based hierarchical clustering and compressed forwarding based protocol for mobile sensor networks gives better results. This paper has shown comparable between existing and proposed Wireless Sensor Network Lifetime on the basis of parameters like Network lifetime, Data packet delivery, First node dead time and Remaining energy. This proposed technique PSO based hierartchical clustering shows better results as compared to the existing technique.

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