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ARTIFICIAL BEE COLONY ALGORITHM BASED DELAY ENERGY EFFICIENT SLEEP SCHEDULING IN WSN

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ABSTRACT: In wireless sensor network consists of huge amount of sensors nodes which are closely organized above a huge region. Each and every sensor nodes monitor the substantial situation and commune through wireless signals. These types of applications nodes in the sensor networks are predictable to be effort to work long period of time not including battery charging. To extend the network life times earlier work several number of sleep scheduling work have been carried out, but which may cause the major problem of communication delay. Previous methods still not reduce the broadcast delay, to overcome this problem in this work proposed a traffic examination result based on the Artificial Bee Colony (ABC) with sleep scheduling node searches the path in the graph for broadcasting communication. In this work the node detects a critical occurrence throw and node alongside a prearranged path according to delay energy efficient scheduling offset schedule beginning ABC Colony algorithm. The Artificial Bee Colony algorithm is for delay efficient data during the broadcasting data from one node to another node which replicate the activities behavior of node colonies analysis traffic path in wireless sensor networks. It also show that that proposed DEESL-ABC(Delay Energy Efficient Sleep Scheduling –Artificial Bee Colony) for every sensor significant delay can be achieved over delay energy efficient sleep scheduling whereas preserve the similar responsibility .

Keywords: Wireless sensor network (WSN), Sleep scheduling mechanism, Artificial Bee Colony (ABC), Graph Theory.

1. INTRODUCTION

Wireless sensor networks (WSN) are predictable to manage for months if not existence on minute low-cost succession with inadequate lifetimes. Consequently energy effectiveness is characteristically the most important goal in these networks. Previous works have well-known redundant eavesdrop of energy consumption [1-3]. Capacity on presented sensor mechanism shows that inoperative pay attentions put away almost the similar control. In sensor network appliance where the interchange load is extremely illumination the majority of the time, it is consequently pleasing to revolve off the broadcasting whilst a node does not contribute in every data delivery. Although the corresponding small duty cycle function of a sensor network is power well-organized, it has one most important insufficiency. At a source node, a variety evaluation might suggest itself throughout the sleep period and has to be waiting in line until the vigorous period. An intermediate node might include waiting in anticipation of the recipient wake up earlier than it can frontward a packet established beginning its preceding bound.One disadvantage of this division of technique is to facilitate they necessitate numerous sensors effective in alternating epoch. As a result, these sensors determination be scheduled addicted to sleep repeatedly, which is destructive to route and might decrease the lifetime of sensors.

In WSNs, sensors frequently contain two function modes, i.e., lively mode and sleep mode. A sensor in lively mode can carry out it's observe assignment and accordingly wants to use a comparatively huge quantity of energy. On the special, a sensor in sleep mode does not carry out the sensing assignment and use small energy [4][5]. Consequently, by suitably scheduling sensors the network lifetime is able to be expanded. In the literature, a variety of efforts have been completed on wake-up scheduling in WSNs. The majority of sleep scheduling methods [6-8], focal point to reduce the energy utilization. In scenarios wherever reducing sleep latency is not significant [9] also present an outstanding examination on boundaries on the interruption of sending data beginning a node to a drop by means of an entirely decentralized duty cycling system.

However the transmissions data rate of this linear amplify is not reliant on the position of the nodes, but the nodes may not reduce the delay rate of the communication when sleep durations. The delay energy scheduling mechanism in the subsequent method: make active a division of sensors when the network establishes effective. These active sensors are referred to as the primary cover set, through which the entire region be able to be experimental. In this work we focus on sleep scheduling methods to reduce the delay in the energy utilization and to expand the network lifetime duration in large scale WSNs. If any nodes went to critical state the ABC automatically activates the sleep node to active state and discovers the best path in the network to transmission of data in the path throughout the graph. The destination node wakes up instantaneously whilst the source nodes attain the distribution packets. Here, the spreading energy delay is concentrated. It can be achieved over delay energy efficient sleep scheduling whereas preserve the similar responsibility.

2. RELATED WORK

Suitable to the usefulness of get up arrangement in conserve power in WSN applications, this study subject has concerned increase quantity of importance in academia. Cardei et al [10]. Enhanced the life span of WSNs through organize the sensors interested in a maximal of disjoint cover sets. They created the difficulty as a maximum-flow complexity as well as presented a MC-MIP algorithm. To deal with this difficulty, Slijepcevic et al. [11] most constrained-minimally constraining covering (MCMCC) is an estimation move toward as well as shown to achieve very fast even in great scale WSNs. Though, the MCMCC cannot promise judgment the overall optima, for it simply uses the restricted heuristic information.

Some interrelated work preserve also be establish in [12][13], where heuristic algorithms are planned to exploit the amount of disjoint cover sets. Extra recently, evolutionary algorithms include also be used to investigate greatest amount of disjoint cover sets. Lai et. al [14] future a genetic algorithm (GA) base method GAMDSC supposedly get near-optimal result, other than it is merely appropriate for position coverage troubles. Hu et al [15] considered an improved GA (STHGA) which occupies a forward encoding technique as well as three plan conversion processes to locate greatest amount of disjoint cover sets. It performs better than to achieve improved than the MCMCC as well as GAMDSC. Lin et al.[16] planned an ant colony optimization support technique to exploit the life span of heterogeneous WSN through decision for utmost disjoint cover sets.

Although some modern papers in sensor networks [17-20] have exposed to wireless links protect be quite unpredictable as well as differ appreciably in package reception rates in every one way, contain make use of a graph-theoretic problem that corresponds to binary link. This is acceptable since the communication chart are analyzing toward is not essentially the full wireless network, however a logical topology which preserve be created, for example, by filter out all defective/unidirectional links. Others contain suggested to facilitate such filtering is required for reliable packet release in several case [19].

3. ARTIFICIAL BEE COLONY ALGORITHM BASED DELAY ENERGY EFFICIENT SLEEP SCHEDULING PROBLEM

In this consider the delay energy efficient sleep scheduling algorithm by concern of energy with number of sensor network nodes $S = \{s_1, s_2, \dots . s_N\}$ that are randomly position in a $N \times N$monitoring region. Due to the differentiation of original energy and with the intention of the energy utilization in message, being sensor have dissimilar lifetime. The delay energy scheduling mechanism in the subsequent method: make active a division of sensors when the network establishes effective. These active sensors are referred to as the primary cover set, through which the entire region be able to be experimental. Further sensors are scheduled to be in sleep mode for preserve energy. Previously a vigorous sensor runs elsewhere of energy, definite sensors in sleep mode determination be make active to make sure the entire monitoring district is still experiential. These procedures persist awaiting the network condition cannot be satisfy. To ensure whether a network is functioning appropriately, need to calculate the coverage area. First, the whole monitor region is divided into $U \times V$small network. Then the estimate exposure area of the network is able to be calculated through

$$v = \frac{C}{U \times V} \rightarrow (1)$$

where$C$ is the numeral of network enclosed through at least single active sensor. According to (1), $\upsilon = 1$ means the entire region is enclosed through the active sensors and the complete coverage prerequisite is contented. Or else, the network complete coverage restriction is not content. Known a set of sensors, the higher bound of the network life span can be predictable through

$$\tilde{T} = \min\{T_1, T_2, \dots T_{U \times V}\} \rightarrow (2)$$

Where T_i is the greatest time of the network be covered through sensors as can be calculate through

$$T_i = \sum_{s_j \in N(i)} t_j, i = 1,2, \dots U \times V \rightarrow (3)$$

Where $t_j$is the lifetime of sensor s_j. It should be noted that the true utmost network time duration is less than or equal to $\tilde{T}$.

Let consider the graph before preceding the traffic pathway beginning sensor nodes ,$G = (V, E)$ be an subjective graph. Let k be the constraint with the intention of order the duty cycling necessities. As states originally focal point on the solitary wake up program case wherever the schedule duration is k slots and every one sensor is allocate one of these k slots. Assigning a slot $s \in [0 \cdots k-1]$ to a join i schedules i to make active its broadcasting for in receipt of simply at slot s. While i can broadcast at any slot, it be able to simply receive data at the establishment of slot s. Let $f : V \rightarrow [0 \cdots k-1]$ be a period task function with the intention of allocate a slot to each node in the grid. Clearly f establishes the delay acquire in broadcasting data beginning single node to the further. For a specified f, let $d_f(i, j)$ be the delay in broadcasting data beginning i to j where $(i, j) \in E$:

$$d_f(i,j) = \begin{cases} k \text{ (if } (f(i) = f(j))) \\ (f(j) - f(i)) \bmod k \text{ (otherwise)} \end{cases} \rightarrow (4)$$

$$d_f(i,j) + d_f(j,i) = \begin{cases} k \ (\text{if } (f(i) \neq f(j))) \\ 2k \text{ (otherwise)} \end{cases} \rightarrow (5)$$

$$d_f(P) = \sum_{(i,j) \in P} d_f(i,j) \rightarrow (6)$$

In this proposed an Artificial Bee Colony (ABC) algorithm, for delay efficient data during the broadcasting data from one node to another node which replicate the searching activities of a bee colony [21].It consists of three categories of beesnamely employed, onlooker and scout bees. The process the transmission of data in nodes the network is divided into equally for both employed bees, and onlooker bees. Employed bees are accountable for make use of the nectar nodes delay results discover earlier than and generous information for the future bees in the highest level with less delay in the sleep scheduling nodes about the superiority of the food source sites(delay broadcasting data). Onlooker bees wait in the delay energy efficient sleep scheduling and decide on a greedy selection process among delay in transmitting data $\nu_i$and x_i and select the better one less delay through the employed bees. Scouts bee randomly searches the less delay energy efficient in the broadcasting data from one sensor node to another sensor node to discover new delay energy efficient depending on a central enthusiasm. These developing intelligent activities of the nodes to detect less energy delay in foraging bees can be review as follows:

1. At the early stage of the foraging (nodes) process, the bees that start to discover the paths in the delay energy efficient for broadcasting data the surroundings randomly.
2. After finding a path then it searches the best less delay broadcasting transmission data. The employed bee returns probabilistic assortment method, as the nectar amount of delay energy transmission data with less $D_{f_i'}$ increases, the numeral of onlooker's bees searches the investigation results. If her source is tired, she turns into a scout and begin to indiscriminately exploration for a new path way.
3. Onlooker bees waiting its until it reaches the less delay in transmission for sleep nodes and choose a less delay energy transmission depending on the frequency of a number of sensor nodes .

In the ABC algorithm the position of a path way (food source) characterize a probable result to the less delay optimization problem. It is working by onlooker bee. If it is equal to number of solution for less delay with number of cycle, then is selected best else it is discarded. Using the correspondence among developing aptitude in foraging of bees ABC algorithm is able to exist give explanation as go behind.

If the investigate freedom of the less delay transmission is calculated of the peak transmission solution for transmission delay to contains with indiscriminately build the solutions in the investigation transmission delay. Original transmission delays are produced indiscriminately inside the assortment of the limits of the constraints.

$$x_{ij} = x_j^{min} + rand(0,1)\left(x_j^{max} - x_j^{min}\right) \rightarrow (7)$$

where$i = 1 \ldots SN, j = 1 \ldots D. SN$ is the number of the transmission delay pathway and D is the quantity of best possible transmission delay solutions . In addition, initially number of generation is set to zero. Execution criterion for the ABC path scheduling schema nerve is accomplishment a maximum cycle number (MCN).

In ABC, judgment a neighboring of the path for transmission delay is distinct by (8)

$$\nu_{ij} = x_{ij} + \phi_{ij}\left(x_{ij} - x_{kj}\right) \rightarrow (8)$$

Within the neighborhood of each path transmission represented by x_i, a food source $\nu_{ij}$is single-minded by altering single constraint of x_{ij}. In Eq. (8), j is a random integer in the variety $[1, D]$ and $k \epsilon \{1, 2, \ldots SN\}$ is a indiscriminately selected index that has to be dissimilar from ϕ_{ij} is a dispersed real arbitrary numeral in the assortment $[-1, 1]$. As can be seen beginning Eq. (8), as the differentiation among the parameters of the x_{ij} and x_{kj}decreases, the perturbation on the location x_{ij} reduces. If restriction assessments formed through this process go over its prearranged restrictions, the constraint can be set to a suitable value. In this effort, the assessment of the restriction beyond its state line is position to its limitations. if $x_i > x_i^{max}$ then $x_i = x_i^{max}$ if $x_i < x_i^{min}$ then $x_i = x_i^{min}$ .Afterproducing the delay energy broadcasting delay ν_i inside the boundaries, a fitness value for a delay difficulty can be consign to the result $\nu_i$as a result of ,

$$\text{fitness}_i = \begin{Bmatrix} \dfrac{1}{(1 + f_i)} & \text{if} f_i \geq 0 \\ 1 + abs(f_i) & \text{if } f_i < 0 \end{Bmatrix} \rightarrow (9)$$

$$f_i = \arg\min_{f_i'}\{D_{f_i'}\} \rightarrow (10)$$

wheref_i is the cost value of delay broadcasting data for result path ν_i. A greedy selection is useful among $x_i$and ν_i; then the improved individual is elected depends on f_i is the cost value of delay broadcasting data of the path results for each bees at x_i and ν_i. If the paths at ν_i is greater to with the intention of x_i in terms of productivity, the employed bee remember the new path and not remember the old path result. Or else the preceding path is kept back in remembrance. If x_i cannot be enhanced, its counter property the amount of trials is increased by one, or else, the counter value of the trail is rearrange to zero.

After completion of employed bee's process in the broadcasting transmission delay in the path from graph then onlooker bee estimate the nectar nodes pathway information taken beginning each and every one employed bees and chooses a best less delay energy efficient broadcasting transmission delay depends on the probability value (11).

This probabilistic collection depends on the $f_i = \arg\min_{f_i'}\{D_{f_i'}\}$ of the result in the nodes for graph.

$$p_i = \frac{\text{fitness}_i}{\sum_{i=1}^{SN}\text{fitness}_i} \rightarrow (11)$$

In this probabilistic assortment method, as the nectar amount of delay energy transmission data with less $D_{f_i'}$ increases, the numeral of onlooker's bees searches the investigation results. If the probability value p_i related through that starting place is better than this delay fitness then the onlooker bee searches the food source by updating by using Eq. (8). After the less delay energy efficient food source is estimate, greedy variety is useful and the onlooker bee moreover remember the novel location by not remember the old one less delay energy . If solution x_i may not be enhanced, it's the value of the trail is increased by one , or else, the offset is rearrange to 0. In order to make a decision if a delay energy broadcasting data with more delay is to be discarded, it is automatically restructured throughout exploration are used. If the assessment of the respond to is greater than the $limit$ organize restriction of the ABC algorithm, then source connected through this counteract is unspecified to be tired and is discarded. The food source(less delay energy transmission data) discarded by its bee is substitute through a new less delay energy efficient sleep scheduling discovered by the scout, which characterize the harmful reaction mechanism and changeability possessions in the ABC. This is replicated by generate a location point indiscriminately and substitute it through the abandoned individual delay energy efficient. Assume that the discarded basis is x_i, then the scout indiscriminately discovers a new x_i with a new $d_f(i,j)$ be the delay in transmitting data from i to j produced solution by (7). In fundamental ABC, it is unspecified that simply single delay energy efficient can be tired in every cycle, and merely solitary employed bee be able to exist a investigate. If it reaches maximum number of cycles it is considered as worst solution for delay transmission data.

Algorithm 1: Delay energy efficient sleep scheduling ABC

1. Initialize the number of nodes in the population as solutions x_{ij} $i = 1..,SN, j = 1,\dots.D$, $trail_i = 0$, $trail_i$ is the none of the solution found for each nodes in the network path for sleep nodes x_i, used for abandonment
2. Evaluate the network path population in the graph
3. $cycle = 1$
4. repeat //the steps until the number of nodes in the delay energy efficient sleep nodes
5. {——Produce a new food source population for Employed bee——}
6. for $i = 1$ to SN do
7. Produce a new food path energy efficient with less delay in transmitting data in the graph $v_i$for the employed bee of the food source x_i by using (8) and evaluate its quality
8. Apply a greedy selection process between v_i and x_i and select the better one
9. If solution $x_i$does not improve $trial_i = trial_i + 1$, otherwise $trial_i = 0$
10. end for
11. Calculate the probability values p_i delay in transmitting data by (11) for the solutions using fitness values
12. $\text{fitness}_i = \begin{Bmatrix} \frac{1}{(1+f_i)} & \text{if } f_i \geq 0 \\ 1 + abs(f_i) & \text{if } f_i < 0 \end{Bmatrix}$
13. $f_i = \arg\min_{f_i'}\{D_{f_i'}\}$
14. {——Produce a new food source population for onlookers——-}
15. $t = 0, i = 1$
16. repeat
17. if $random < p_i$ then
18. Produce a new delay in transmitting data v_{ij} food foundation by (8) for the onlooker bee
19. Apply a greedy selection process among delay in transmitting data $v_i$and x_i and select the better one less delay
20. If solution x_i delay in transmitting data does not improve $trial_i = trial_i + 1$, or else $trial_i = 0$
21. $t = t + 1$
22. end if
23. until $(t = SN)$
24. {——Determine Scout——}
25. if $\max(trial_i) > limit$ then
26. Replace x_i with a new $d_f(i,j)$ be the delay in transmitting data from i to j produced solution by (7)
27. end if
28. Memorize the best solution achieved so far
29. $cycle = cycle + 1$
30. until $(cycle = \text{Maximum Cycle Number})$

4. EXPERIMENTAL RESULTS

In this section, measure the result of the experimentation consider the simulation tool ns2 and set different test cases within the sensor nodes deployed data region in a $100m \times$

100m rectangle region. The original duration of every sensor is regularly circulated among 0.75 and 1.1. The sensing radius of every one sensor is set to exist $R = 25$ m. In order to show the efficiency and effectiveness of the proposed Delay energy efficient Sleep scheduling ABC (DEESL-ABC), are used for comparison. It show that using DEESL-ABC shows that proposed system can work further efficient than the DEESL. Then set the working time of every region to be the through duration of sensors in the region.

Table 1: Result for sleep scheduling methods

Test case			DEESL		DEESL-ABC	
Id	$\tilde{C}$	$\tilde{T}$	$\tilde{C}$	$\tilde{T}$	$\tilde{C}$	$\tilde{T}$
1	20	19.8	20	18.25	20	19.8
2	21	20.1	21	19.45	21	20.1
3	22	21.5	22	20.12	22	21.5
4	23	22.34	23	21.01	23	22.34
5	24	23.8	24	20.13	24	23.8

Table I lists the results computed by DEESL, DEESL-ABC on five 200-sensor networks. In Table I, $\tilde{C}$ and $\tilde{T}$ respectively represent the coverage nodes in the network and lifetime duration for different nodes, while the T in the column correspondingly characterizes the standard set-up duration establish through the DEESL, and DEESL-ABC. It can be experimental that, even though DEESL-ABC can discover the utmost number of cover sets on every one cases, the total network duration of each nodes are achieves best of network lifetimes. This is given that the duration of a cover region is needy on the shortest duration sensors. By construction make use of the global investigate capability of ABC and efficient restricted heuristic information, the DEESL-ABC achieve the most excellent on every one test cases. It discovers the every bound result with lifetime duration on every one test case.

The following Figure 1 shows the results of network lifetime duration for different sensor nodes in WSN .For each and every setting five different sensor network nodes are generated for test cases along with cover set region and average results for time duration of the network are showed in the axis. It can be experimental to the regular network lifetime period increases when the amount of sensor network nodes becomes high.

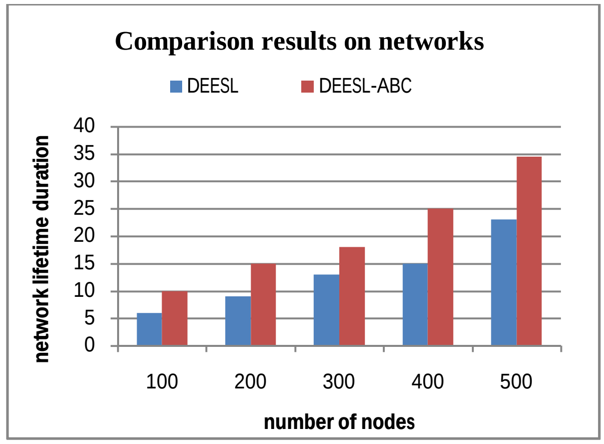

Figure 1: Comparison results on networks with different number of sensors

5. CONCLUSION AND FUTURE WORK

In this we addressed the important problem of minimization of the message delay over the energy when it moves from sleep state to active state periodic sleep cycles for nodes in WSN. The main objective of the work is to reduce the latency specified the task cycling constraint that every one sensor has to be aware for average time slots for each and every duration. In this work DEESL with ABC algorithm searches best minimization of the communication delay over the energy periodic sleep cycles for nodes in WSN. Each bee measured as nodes progress from one sensor nodes to other nodes, where each sensor can wake up at accurately duty cycling time phase. By giving the sleep schedule of a node a counteract to depends leading its intensity of the data assembly graph nodes outcome by the way of ABC. It also fine-tunes the duty cycling time periods continuously according to the traffic load in the WSN. It can select numerous of the wakeup concurrently for each sensor network nodes. So it must decrease the communication latency delay among one sensor nodes to another sensor node.

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