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Best fit Node Placement based Congestion Control Mechanism in WSNs.

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ABSTRACT :*In wired networks collision congestion on its network nodes is the dignified source of packet loss and delay. Thus protocols like the TCP use various congestion control algorithms like delay based and loss based to tackle this problem of congestion. In wireless sensor networks (WSNs), however apart from the above problem of congestion, the node random movement, node distance becomes another cause of delay and packet loss. The use of proposed algorithm Best fit node movement based congestion control can lead to very conservative and technical movement for avoiding congestion. The regression method and circle forming method of node movement through the network it can move a safety direction for avoid congestion with support of this regression technique, the node can get the best fit network topology time. By simulation result shown that the proposed technique attains high delivery ratio and throughput with reduce delay when compared with the different existing technique.*

Keywords: Congestion Control, Wireless sensor network, Regression method, Node movement, Circle formation

1. INTRODUCTION

Recently intermittently connected wireless network (ICWN) has received wide attentions from academic and industry. Wireless sensor nodes are small predefined computing devices that interact with sensors and communication using short range wireless transmitters. Those nodes work automatically but co-operatively to generate a logical network in which data packets are transferred based on nodes management. A wireless sensor network (WSN) comprises of potentially high number of nodes that may be travelled over a wide geographical area. WSN nodes perform random or static movement both of them face some problems and finally explore the congestion [18]. Congestion control and avoidance includes measures takes for manipulating the traffic within the network. Node placement performs the major contribution of reliable data transaction without congestion [17]. So the node distribution and random movements, a connection between two nodes is dynamic [10]. On the other hand in practice the node movement can improve the throughput of establishing a connection and thus the network capacity can be improved [3, 4]. Here using the regression based node management way for data transmission.

There are various protocols proposed in literature for congestion control in wireless sensor networks. These algorithms designed for controlling or avoiding congestion in wireless sensor networks under four different node placement layouts. The examined algorithms are SenTCP [1], Directed Diffusion [2] and HTAP [3]. The main contribution of this work from others is that Simple Diffusion, and combination of Constant Placement and Random placement algorithms are evaluated in wireless topologies. Hence, in this paper, provide related results from all the categories of congestion control and reliable data transport algorithms in WSNs, under different placements. Simulation results show that the performance of specific algorithms can be improved under specific placements and avoid the congestion.

2. RELATED WORK

Several node placements technique have been proposed in literature concerning WSNs. In [19] authors study the energy utilization performance of HTAP algorithm [17] under specific node placements, in correlation with Directed

Diffusion[16] algorithm. Simulations results show that the performance of HTAP, a "resource control" algorithm, is improved when nodes are densely deployed near hotspots.Younis et al [20] present a survey for strategies and techniques for node placements in WSNs and provide a categorization of the placement strategies into static and dynamic, depending on whether the optimization is performed at the time of deployment or while the network is operational. In [22] authors evaluate the tolerance against both random failure and battery exhaustion from the viewpoint of stochastic node placement. They consider three typical types of stochastic sensor placement: Simple diffusion, Constant Placement and R- Random placement. In [23] authors studied the problem of determining the critical node density for maintaining k-coverage of a given square region. They have considered three different deployment strategies: Poisson point process, uniform random distribution and grid deployment and have shown that the two random strategies have identical density requirements for k-coverage. They also showed that grid deployment requires less node density than the two random deployments strategies in order to achieve the same level of coverage degree.

Thus, in this work study the behavior of a representative algorithm of each category when nodes are placed under different placements. Specifically we employ Sen TCP [1,15] as a "traffic control" algorithm, HTAP [17] as a "resource control", ESRT [14] as a "reliable data transport" algorithm as well as "Directed Diffusion"[16] as a "multiple path creation" algorithm and CODA [13] ”Congestion Detection and Avoidance in Sensor Networks”.

3. ALGORITHM OVERALL BEHAVIOR

The node density is only one factor that affects network topology. Placement of nodes in a network can be divided into three major categories concerning the way that nodes are placed in the field. These are the deterministic node placement, the semi- deterministic node placement and the non-deterministic (stochastic) node placement.

In this work to compare nodes in two different placements in order to cover these categories. A semi- deterministic (Biased Random) and non-deterministic (Simple Diffusion and Random).

3.1. Non - deterministic node placement

Deterministic placement is not so realistic when many sensor nodes are placed in a large area [5,6]. In such a situation, stochastic placement is needed. Eg. Random placement [9].

Random Placement :

1. Commonly used topology and sensor nodes are placed so that their density is uniform[8,21].
2. Random movement produce the un necessary collision [7].
3. Maintaining attraction , repeltion for each nodes is difficult task[11,12].

Note that the actual node placement is performed in random way in these areas (Fig. 1)

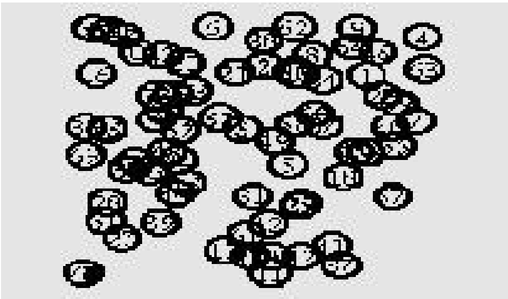

Figure. 1 Random Placement

3.2. Semi- deterministic node placement

In Deterministic and non- Deterministic node placement compulsively face the collision and congestion in earlier. So here proposed Regression and Circle forming based Biased Random Placement for avoid and control the congestion. Semi- deterministic placement is the placement, where, although individual nodes are placed in a non- deterministic way on the grid (e.g random) the areas where nodes are going to be spread are deterministic.

3.2.1. Regression based Biased Random Placement:

1. Technique can remove congestion quickly and reduce packet dropping, which in turn conserves energy.
2. Form the straight line node for data transmission.
3. Choose the next nearest node for data transmission in regression way.
4. Form a random movement for reach the degraded.

Note that the actual node placement is performed in Regression based Biased Random way in these areas (Fig. 2)

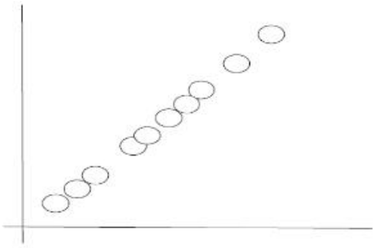

Figure. 2 Regression based Biased Random Placement

Algorithm.1 explains Regression based Biased Random Placement in Wireless Sensor networks to enhance the overall performance and control the packet loss and improve the network utilization while present the fairness.

Algorithm 1. Regression based Biased Random Placement Algorithm

1.initialization

2.$X \leftarrow 800$ (max X) , $Y \leftarrow 800$ (max Y)

3.$i \leftarrow 0, n \leftarrow 70$ (max nodes)

4.Event on i ≤ n do

5.Calculate a value as Eq. (1) and b value as Eq.(2) for find a and b value

$NA + B \sum X = \sum Y$ (1)

$N\sum X + B \sum X^2 = \sum XY$ (2)

6.Calculate Y value in Eq. (3)

$Y = A + B$ (3)

7.If $Y \geq 1$

8.continue Biased Random Placement

9.else

10. Random movement

11. End

3.2.2. Circle forming based Biased Random Placement:

1. Technique can remove congestion quickly and reduce packet dropping, which in turn conserves energy.
2. Form Circle in grid based on each centroid node for data transmission.
3. Choose the next nearest node for data transmission in next nearest way.
4. Form a random movement for reach degraded.

Note that the actual node placement is performed in Regression based Biased Random way in these areas (Fig. 3)

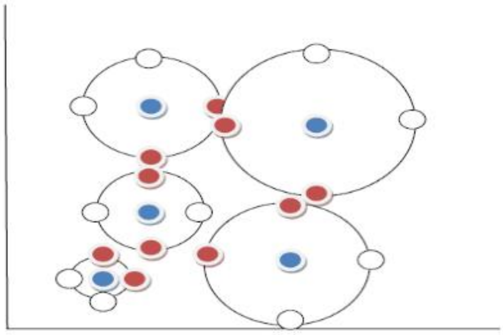

Figure. 3 Circle forming based Biased Random Placement

Algorithm.2 explains Circle forming based Biased Random Placement in Wireless Sensor networks to enhance the overall performance and control the packet loss and improve the network utilization while present the fairness.

Algorithm 2 Circle forming based Biased Random Placement

1. Initialization (x, a, b, r, i, N),

$\boldsymbol{X} \leftarrow \boldsymbol{8}$ (max X) , $\boldsymbol{Y} \leftarrow \boldsymbol{8}$ (max Y), $\boldsymbol{i} \leftarrow \boldsymbol{0}, \boldsymbol{n} \leftarrow \boldsymbol{7}$ (max nodes)

2. Data transaction

3. Put centroid points random in in Eq. (4)

$$\boldsymbol{N} \quad \boldsymbol{o} \; \boldsymbol{C} \quad \boldsymbol{v} = \frac{\boldsymbol{T} \quad \boldsymbol{ni} \quad \boldsymbol{o} \; \boldsymbol{n}}{\boldsymbol{1}} \qquad (4)$$

4. Draw a circle for each centroid Eq. (5)

$(\boldsymbol{x} + \boldsymbol{a})^2 + (\boldsymbol{y} + \boldsymbol{b})^2 = \mathbf{r}^2$ (5)

5. Calculate left,right,up,down nodes for each centroid

6. Place all sub nodes

7. Allow N(i) Centroid = N(i) Subnode

8. If sub circle grid point > current circle grid point then

9. Data transfer to next nearest value of N(i)

10. End

4. PERFORMANCE EVALUATION

For evaluating the performance of proposed design namely Best fit node placement based congestion control Mechanism, which has the ability of increasing the bandwidth utilization over WSNs while maintaining fairness. This module has the ability to be plugged into NS-2 network simulator, in order to evaluate its performance compared to some of the widely deployed Congestion control algorithms.

4.2. The simulation setup

To evaluate the selected algorithms under the proposed technique, a series of simulations using ns-2 simulator, has been presented. The proposed algorithm by comparing its performance with other Non- deterministic node placement algorithms . The conducted experiments have been divided into three main scenarios: packet sending Ratio, packet drop, throughput and delay. Experimental parameter have been shown in Table 1.In all scenarios we choose to deploy nodes within a square area of size 800m x 800mx.

Table 1 Simulation Parameters

Routing Protocol	DSDV
Nodes	80
Mac Type	MAC/802-11
Packet Size	512
Queue Length	50
X Distance	800
Y Distance	800

4.2 Results and discussion

This subsection presents an analytical discussion of the behavior proposed algorithm as Semi-deterministic node placement algorithms and compared to Non- deterministic node placement algorithms. As well as, it presents the results of the performance evaluation and shows the measurements Packet delivery,loss ratio, Throughput, Delay respectively.

4.2.1. Packet delivery ratio

Fig. 4 shows the Packet delivery ratio of the Random, Regression, Circle based node placement methods. Due to the mechanism of Regression and circle expectedly shows the packet delivery growth as followed.

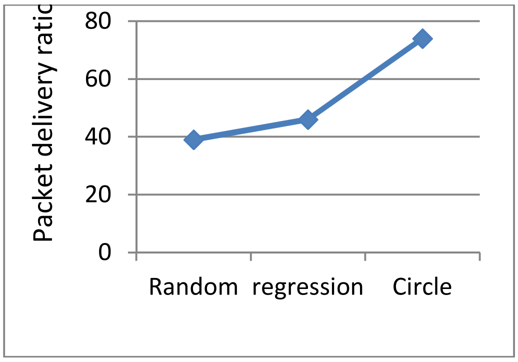

Figure 4.Packet delivery ratio Random, Regression, Circle based node movement

4.2.2. Packet drop ratio

In the next scenario , as shown in Fig. 5, Regression, Circle based node movement has performed in Random node movement discover to reduce the packet drop ratio .

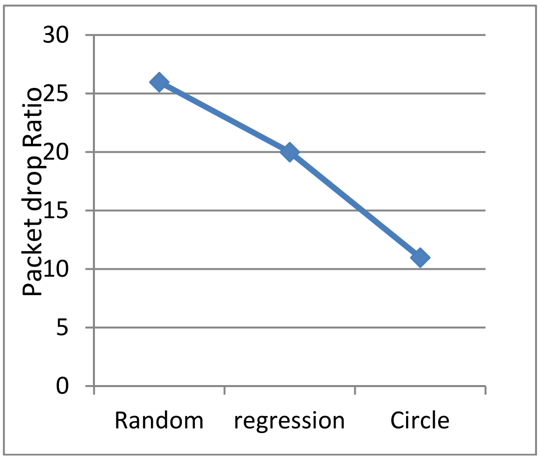

Figure 5. Packet drop ratio Random, Regression, Circle based node movement

4.2.3. Throughput

In the next scenario , as shown in Fig. 6, Regression, Circle based node movement has performed in Random node movement discover to improve the throughput .

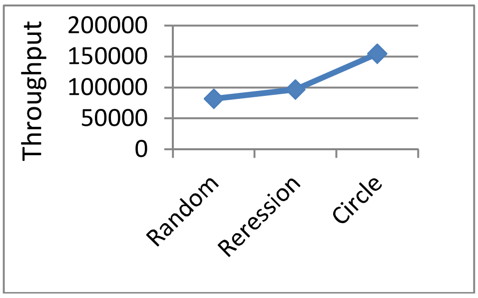

Figure 6. Throughput for Random, Regression, Circle based node movement

4.2.4. Packet Delivery ratio for various node placement

In the next scenario , as shown in Fig. 7, has performed in different deterministic node placement and finally find the performance of semi deterministic node placement is better than the other node placement terms of sending rate due to increase a growth of packet delivery ratio .

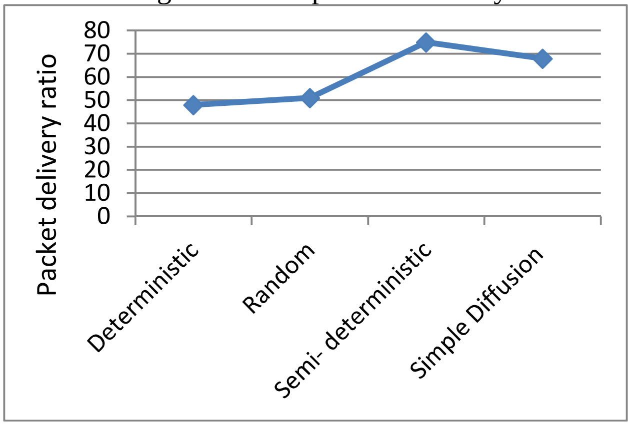

Figure 7. Packet Delivery ratio for various node placement

4.2.5. Packet Delivery ratio for various node placement methodology

In the next scenario , as shown in Fig. 8, has performed in different deterministic node placement and finally find the performance of regression and circle based node movement is better than the random node placement terms of sending rate due to increase a growth of packet delivery ratio .

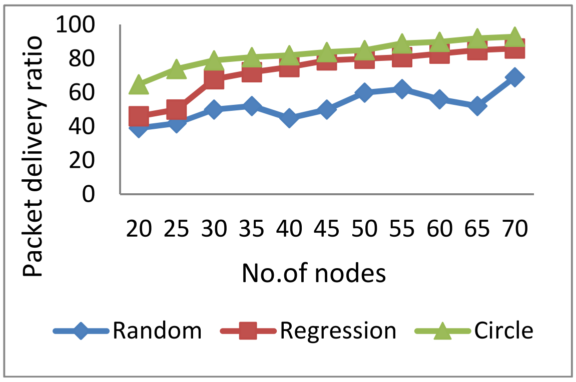

Figure 8. Packet Delivery ratio for various node placement methodology

5. CONCLUSION

In this paper, an Best fit node placement based congestion control algorithm has been proposed. The main contribution of this algorithm is to implement the mechanism of regression and circle forming based biased random placement mechanism. The purpose of the proposed CCA(congestion control Algorithm) has improve the packet delivery, throughput and reduce the delay to compare existing random movement algorithms, especially control the packet loss. Simulation result discover the best performance of node placement and reliable data transmission of semi deterministic algorithm is also better than deterministic, random, simple diffusion node placement. The main objective of this algorithm is to avoid the unnecessary packet loss for random placement of wireless sensor nodes. In the future, the proposed work is integrated with nature inspired congestion avoidance, for improving the flocking behavior and improving the performance of WSNs .

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