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IMPROVING THE ENERGY EFFICIENCY FOR MOBILITY BASED MULTI-SOURCE MULTI-DESTINATION WIRELESS SENSOR NETWORKS

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Abstract:

Efficiency of routing technique for mobility based WSN, can be obtained by collecting and maintaining nodes information for verification in a specific route. Network communication effectiveness completely depends on the path, network topology and the dynamic nature of the network. In terms of the node's moving speed, it affects the energy factor which is the most important property leads effective communication and data transmission in the network. To provide a better solution, a Dynamic Tree based Parent Child (DTPC) routing is applied to maintain the route during mobility based communication is proposed here. DTPC collects the entire information about the source node, destination node along with the intermediate nodes and maintains it for effective routing. DTPC reduces the energy consumption for mobility based node communication. The simulation results show that the DTPC is more efficient than the existing approaches. Also this paper proved that the efficiency of the proposed approach is higher than the existing approaches. Using this method, the energy efficiency can be improved in multi path multi destination wireless sensor networks. It finds its application in surveillance monitoring, health care applications, pervasive and context aware computing, military, space research etc.

Keywords: Wireless Sensor Network, Mobility Nodes, Energy Consumption, Dynamic Tree, Routing.

1. Introduction:

Wireless Sensor Networks have come presently into all kind of applications due to the base element used in the hardware design such as sensor device. The sensor devices are tiny and limited in energy. The most recent and growing application under WSN are surveillance monitoring, health care applications, pervasive and context aware computing, military, space research and so on[1-2]. The efficiency of the applications can be obtained by validating the nodes in terms of sensing quality, flexibility, energy consumption, mobility etc. One of the recent applications is data collection where it determines the performance of WSN[3] too. One of the important factors to be considered for success the applications in WSN is energy. If the node is long time alive it can continue its effectiveness in application. Else if the node dies then the application is terminated.

2. Background Study

Various topology, routing protocols and network management are proposed to utilize the WSN in data collection area[4]. Generally the topology of WSN creation is used to solve the entire efficiency of the network[5]. Various methodologies are used for energy efficiency. Moreover in special kind of networks some of the strategies are included to ensure the energy efficiency to increase the network life time[6]. The energy efficiency can be provided by MAC based algorithms such as[7 -14]. The energy efficiency can be increased by designing the hardware architecture too[15-16].Nowadays the WSNs are greatly expanded playing an important role for improving the efficiency in data collection and delivery. One of the main issues for the networks mainly in WSN is energy. In this paper improving the efficiency of the network in terms of routing where routing is obtained by DTPC.

3. Dynamic Tree Based Parent Child Routing:

Grouping the nodes for communication during node mobility is a challenging factor. It is necessary to provide an efficient algorithmic approach to overcome the uncertainties caused by dynamic router tables. A sensor node in WSN is nomadic in nature, and it has its own level of constraints in energy wise and operation wise. During communication the nodes are identified including source and destination will be updated in path routing table where communication is going to take place. If any contingency happen in case of transmission time due to disconnection, packet loss, maximum delay, or any other external factor means, retransmission will takes place. But this is time consuming and it needs all the process which has been carried out in last communication including updating the routing table. There is a lot of algorithms were carried out to enhance the routing table updating in dynamic ways. But again all is more specific for individual application domain. By keeping this into account, a generalized dynamic routing by exploring node tree is proposed in this paper. Here the nodes are identified and all the nodes are initially communicate with the base station or the node which is allotted to be monitor node. Then if communication is established then from source to destination nodes including the nodes are the part of the communication is considered by dynamic vector routing called distance vector routing, based on this, a tree is constructed with parent child relationship.

The tree is constitutes from source as root node and destination in leaf node or last node. Intermediate nodes are the number of branches in the tree. Using breadth first search node from source is passing through the branches and reach destination node which is in tree leaf. Tree hierarchy may change due to mobility; there is an ambiguity to reach the destination route, if one link of breadth first search fails. It will enhance the feature more into full filled model. Once destination accepts the data packet, tree is cleared and node is waiting for communication. Every time interval specified, router updates dynamically the route information. It includes source to intermediate node information and destination node. Whenever router receives update from the node location change it finds the distance by analyzing the tree components update and builds the tree.

Node Deployment Diagram

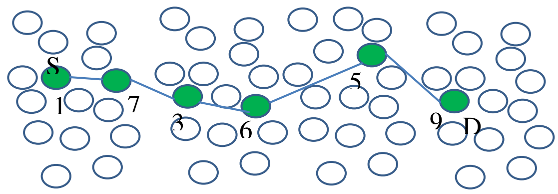
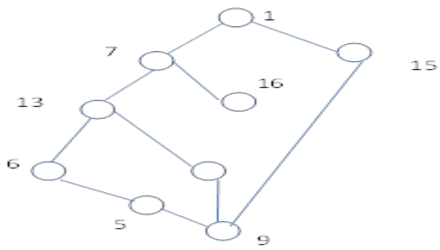


Figure-1. Node Deployment and Route Construction.

The established path P is = {S (1), 7, 3, 6, 5, D (9)} is shown in Figure 1. The dynamic tree creation from source to destination is shown in Figure 2.



Fgiure-2. DFS based Routing.

According to the DSDV the routing is applied in dynamic breadth first search tree. N1 is the source node and the N9 is the destination node. Table1 says about the delay taken to from node-to-node in the route. The values in the Table1 are generated randomly in simulation**.**

Table1. Delay Tabl

	N1	N7	N13	N6	N15	N23
	Vectors Received from Destination/Intermediate Neighbors					
N1	0	1	12	6	5	7
N2	18	6	12	20	3	14
N3	6	11	9	19	6	11
N4	2	15	5	9	16	12
N5	11	14	3	6	8	8
N6	9	7	3	0	15	9
N7	18	0	17	12	11	14
N8	5	20	9	16	18	8
N9	5	9	2	1	20	3

N10	19	4	8	11	12	2
N11	3	18	13	1	5	5
N12	8	19	6	17	12	6
N13	18	19	0	8	20	5
N14	17	20	8	4	12	13
N15	1	5	17	15	0	1
N16	12	6	3	4	15	10
N17	14	5	7	15	15	16
N18	1	1	18	2	2	19
N19	5	11	13	7	4	5
N20	15	1	15	3	3	2
N21	13	8	15	17	14	5
N22	10	10	3	15	12	0
N23	6	20	1	2	13	18
N24	13	17	5	2	10	1
N25	6	8	7	16	16	9
N26	16	1	2	15	13	4
N27	3	2	12	3	6	11
N28—N100	2	13	9	18	13	19

Table-2 shows the cumulative delay of each node participating in the communication. Based on this BFS tree called DTPC and it creates a dynamic tree.

New Routing Table for N9 (Delay)
7
NoUpdt
NoUpdt
NoUpdt
NoUpdt
16
15
NoUpdt
0
NoUpdt
NoUpdt
NoUpdt
5
NoUpdt
17
NoUpdt
NoUpdt
NoUpdt
NoUpdt
NoUpdt
NoUpdt
2
NoUpdt
NoUpdt
NoUpdt
NoUpdt
NoUpdt
NoUpdt

Table2. Cumulative Delay The other nodes are intermediate nodes in the tree. The routing table is updated according to the routing table is given in Table2 and Table3. Then communication will be stopped. Ambiguity: If any available route fails, then contingency path will be followed.

Table-3. Routing Table at Time = t0.

Node	Distance	Next
1	0	-
6	8	7
7	3	7
9	14	15
13	6	7
15	4	15
23	12	13

The main criteria considered here is BFS may or may not pass all the nodes. Instead if it reaches the destination by dynamic adjustment of tree or data packet reached via other path to destination whichever is earlier.

In this paper, a new routing called Dynamic Tree based Parent Child Routing. In this algorithm a routing table is used to store the node details of every route. Initially BFS is used to confirm the connection among the nodes in the network and the nodes should be in parent-child relation. Once the connected nodes are recorded initially then BFS stops its functionality temporarily. In between nodes are branches and all the nodes in the lower lever level are child of the upper level nodes in the tree as in Table 4.

Table-4. Routing table at time=ti.

Node	Distance	Next
1	4	7
6	3	9
7	6	13
9	0	-
13	3	6
15	12	9
23	7	9

This structure changes only after a successful data transmission. Once the data reaches the destination it is assumed that the current process is over between the current source and destination nodes. Also the nodes information is updated after each round of process. In case, of not able to find the node connectivity BFS can be called dynamically and rebuild the nodes connectivity and relationship.

The dynamic changes in the route are calculated in following manner:

Du (7) =min {

c (1,7) + dv(1),

C (6, 9) +dv (6)+c(7,13) +dv(7)} 1. Min {13, 15, 17}

Du (7) =13.

N = G (V, E)

N = set of nodes and routes

E = link set

C (x, x') = cost of link (x, x')

Cost of the path $(x_1, x_2 \ldots x_n) = c(x_1, x_2) + \ldots + c(x_{m-1}, x_m)$

Algorithm Dynamic Vector_ Routing ( )

{

Dist (v) = 1.

Wait for change

Recomputed and estimate of graph

Notify the neighbors

Loop

Find w not to main set N'

Hence,

Dist (w) is minimum

Add w to N' set

N' = {u, w}

Update dist (v) for all adjacent v to w which is not in N'

Dist (v) = minimum (dist (v), dist (w) + cost (w, v))

until all nodes in N'

}

Algorithm Path BFS ( )

{

Check for queue

Loop

Check current node and its neighbors

Transfer data

De-queue the visited nodes

Until queue empty

}

The algorithm is coded and simulated in NS2 software and the results are verified. For this 100 nodes are deployed randomly in the simulation window and the performance is verified. Some assumptions are made in this simulation like nodes are moving.

3. Results and Discussion

The proposed approach is compared with conventional routing mechanism in which number of rounds for dynamic routing is taken around 50. With DTPC dynamic tree creation is obtained and the tree creation time is very minimal comparing to other mechanisms. The same is explained in Figure 3 for 100 nodes deployed in the network.

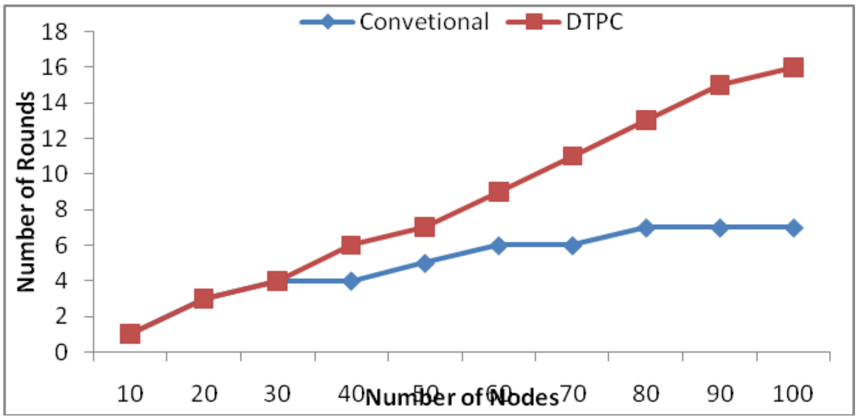


Figure-3. Number of Node vs. Number of Rounds.

According to the dynamic routing the number of data packets transmitted in the established path is as expected shown in Figure 4. Example in this scenario the number of communication in the network is considered above 50.

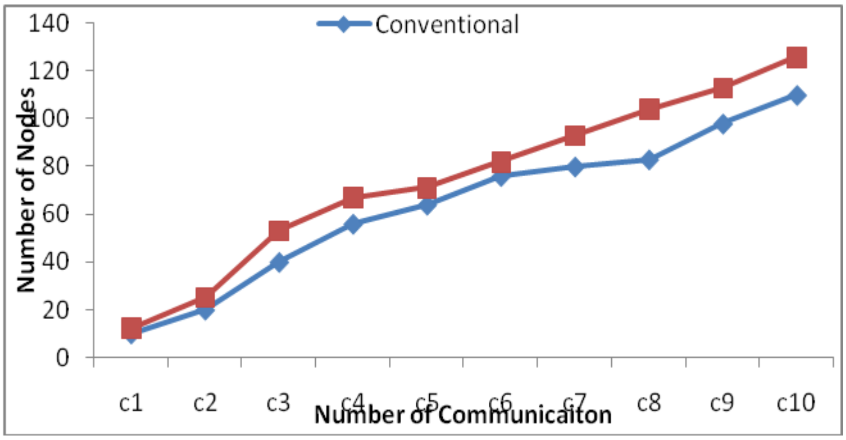


Figure-4. Number of Communication vs. Number of Rounds.

Out of this for the entire network around 97.88% of communication is accepted by given model as in table no 4. An exercise is carried out by making delay of one intermediate node during communication. Due to this timer got lapsed and communication is reinitiated in the anomaly path of DTPC tree. During node mobility the position of the nodes are getting changed. The position is changed with respect to a time interval and node moving speed and this is shown in Figure 5.

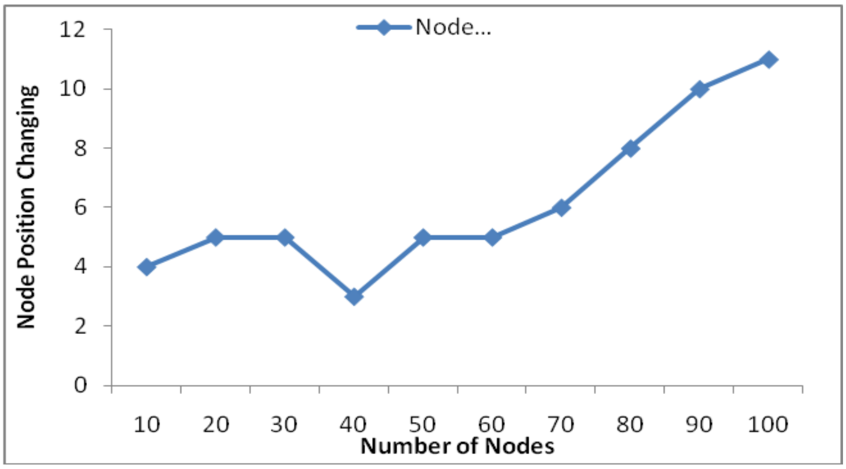


Figure-5. Number of Nodes vs. Number of Nodes Position changes.

DTPC update the routing table according to a delay and change the route. Whenever the delay increased the tree construction for updating the existing route changes is also increased. The tree construction in dynamic is shown in Figure 6.

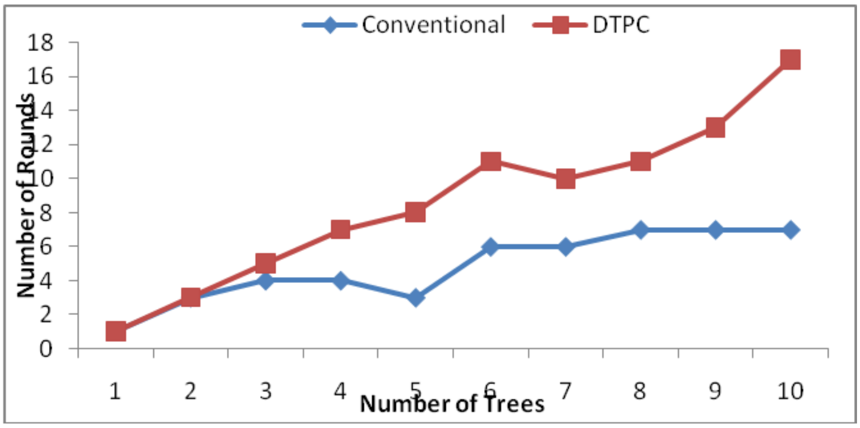


Figure-6. Number of Trees vs. Number of Rounds

From the above Figures 3 to Figure 6 it is clear that the link break is reduced to retain the existing route until transmitting the data packets from source to destination. Hence it is efficient and reduces the energy consumption too.

Conclusion

In this paper the main objective is to do dynamic routing by Dynamic Tree based Parent Child link routing. Main constraint considered here is mobility of the node. When the nodes are moving it is possible the link among the nodes get break due to increased distance among the nodes dynamically. When a node moves, the distance increases so that the RSS gets reduced and the nodes become not reachable between one another. In this paper the DTPC construct a route and updates the route in a periodical manner according to the distance. And repeat the same until it transmit the complete data packets among the source and the destination nodes. Hence this DTPC is efficient for mobility based WSN.

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