Enhanced APTC Technique for Energy-Efficient and Reliable Wireless Communications

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Abstract: APTC is articulation points based topology control, keeps various sensor nodes in randomly distributed way. Each sensor node sends the data from itself to the sink node. For sending the data considers various intermediate node as relay node. Articulation points based topology control helps in controlling the topology. So that minimum number of relay node can be used. In result will waste less energy compared to the other. In enhanced APTC based solution multiple mobile sensor nodes are being kept. These multiple sink node further control the topology, by reducing the number of intermediate relay nodes. Enhanced APTC based technique put multiple sink nodes moves at constant speed. So that the sensor node will transmit the collected data to the nearer sink node. All the parameters like MAC load, Hop Count, Data Transmitted, Residual Energy has shown the improvement. So that enhanced APTC based technique performs better than the APTC based Technique.

Keywords: APTC, WSN, MAC Load, Sink Node.

Introduction

Wireless Sensor Networks (WSN) is the innovation that comprises of expansive number of small sensor hubs disseminated in a specially appointed way. Sensors are by and large spread over a land range in profoundly thick way. These sensor hubs are of ease and low power which can perform different capacities. In WSN, the sensor nodes are deployed in a sensor field. The deployment of the sensor nodes can be random (i.e. dropped from the aircraft), regular (i.e. well planned or fixed) or mobile sensor nodes can be used. Sensor nodes coordinate among themselves to produce high-quality information about the physical environment. Each sensor node bases its decisions on its mission, the information it currently has, and its knowledge of its computing, communication, and energy resources. Each sensor nodes collect the data and route the data to the base station. All of the nodes are not necessarily communicating at any particular time and nodes can only communicate with a few nearby nodes. The network has a routing protocol to control the routing of data messages between nodes. The routing protocol also attempts to get messages to the base station in an energy-efficient manner.

There are various CHARACTERISTICS that are available for the network are

- Densely Deployed Sensor Nodes The sensor nodes are deployed in the area in highly dense order. So that the nodes can collect the data from its environment more precisely.
- Sensor nodes are battery powered Sensor nodes are battery power operated. They have less power to cover up so they dissipates after fixed interval of period. Battery power will get lost when large number of transmissions are receiving of the signals.
- Limited energy, Storage and computation constraints Each sensor node is a small device having sensors for both transmissions are receipt of the signal. They are also of lower cost. That means having less memory. Which can fill after the interval of time.
- Self configurable In initial sensor nodes are randomly deployed. They even can be thrown from the aeroplane in large area. Later on with the help of localization techniques they are being configured so that they can transfers the data.
- Application Dependant This network oriented WSN is application oriented. Because for any type of
application they are being set. So that the transmissions are receipt can be taken place.

- Unreliability of sensor nodes they are lower cost network. So there is a chance of network failure. Also there is no central controller which can control the network configuration. So there is higher number of chances of network failure.

- The frequent change in topology while the nodes are randomly distributed there is a chances that there is frequency fading or isolation of node because of the absence of the relay node. Under such circumstances there requires the topology change so that node fading can be avoided.

- No Global identity Each node is lying in the network as individual node. There is no central identity to the node. So that system cannot be configured with global identity[1].

Hierarchical Routing

LEACH is one of the protocol based on hierarchical based routing. Where sensor network will be sub divided into smaller clusters. Each cluster will be distribution of the sensor nodes randomly. One node based on probability and remaining energy will be selected as cluster head. Sensor nodes will transmit the data to the cluster head and then cluster head the data will be transmitted to the base station. This way data will be aggregated at the cluster head. It will make use of energy more efficiently.

Test case set $S=\emptyset$

For each coverage $C$ do

Find start node, $N_s$

Repeat

Find 100 neighbours by adding one step into $\Sigma$ of $N_c$

Select the best fitness neighbor among the 100 neighbors based on fuzzy logic

If the best fitness neighbor is in userful then

$N_c \leftarrow$ the best fitness neighbor

Else

Break

End if

Until satisfy $C$ or reach maximum iteration

$S=S\cup(\Sigma$ of $N_c)$

End for

Enhanced APTC based approach

Enhanced APTC algorithms are a type of algorithm are to find out the optimal solution to given problem. This optimal solution produces either the maximization or minimization a particular function. The Enhanced APTC approach includes various basic steps like[1].

- Take Multiple Mobile Sink Node.
- Each sensor node transmit the data to the nearer Sink Node
- Aggregate the data at the sink Node.

Test case set $S=\emptyset$

Distribute nodes randomly in whole network.

For each coverage $C$ do

Find start node, $N_s$

Repeat

For($i=0;i<|N_s|/2;i++)$ do

Select two parents in the population

Generate two offspring by crossover operation between two parents

Insert two offspring into new generation list

If a new offspring satisfy the coverage, $C$ then

$S=S\cup(\Sigma$ of the offspring)

Break

End if

End for

Mutate some offspring in the new generation List

Until satisfy $C$ or reach maximum iteration
II. LITERATURE SURVEY

Muhammad Aslam et. al. (2016) The author proposed Two-Hop Centralized Energy Efficient Clustering (THCEEC) and Advanced heterogeneity-aware Centralized Energy Efficient Clustering (ACEEC) routing protocols which are derived from Centralized Energy Efficient Clustering (CEEC) routing protocol for three level heterogeneous WSNs to enhance stability period of nodes and network lifetime of WSN. Applying it, WSN became energy efficient and achieve stable elections.

Ben Liu et. al. (2016) This algorithm uses sink side least-square algorithm, which reduces the communication traffic between sink and the monitoring center, on the side of monitoring center, the incident identification accuracy improved in D-S evidence recognition framework, by using the triangular fuzzy membership function for obtaining basic probability assignment value. It Reduces communication traffic between sink and source and identification accuracy is improved in D-S evidence theory recognition framework.

S.G. Santhi et. al. (2015) proposed an algorithm DCHM used for secure and accurate data fusion as well as Accuracy of data fusion results is also improved. It performs well in improving security and accuracy of data fusion by update reputation and trust systems.

Mohammadreza Soltani et. al. (2014) In this research, kalman filters based on data fusion used to reduce the number of active sensor node in large network, in this Only those sensor considered which are inside of the gate validation region. Reduction of network resources, less network load, secure communication.

The application is suitable for those applications which requires moving type of node. This moving node is such that each moving node cover the large area. All the sensor nodes collect the data from the environment and send to the cluster head and then to the base station. All the sensor nodes collects the data at regular interval and collect data at constant rate. At the mobile node these data will be fused and from fused data the noise is removed and denoised data will be forwarded to the base station.

III. FLOWCHART

IV. ALGORITHM

1. subdivide the network area into various sub parts. Each sub part is cluster and will receive various sensor nodes

\[
\text{Cluster size} = \sum_{i=1}^{n} \text{nth cluster}
\]

2. Put multiple sink nodes in the network area. These sink nodes are moving in nature.

3. Collect the data from the sensor node at the sink node. The path identification using Enhanced APTC based technique will be performed.

4. evaluate the performance parameters for identify the performance of the Enhanced APTC based network.

V. PSEUDO CODE

Test case set S=\emptyset

Distribute nodes randomly in whole network.

For each coverage C do

Find start node, Ns

Repeat

For(\text{i}=0; \text{i}<|\text{Ns}|/2; \text{i}++) do

Select two parents in the population

Generate two offspring by crossover operation between two parents

Insert two offspring into new generation list

If a new offspring satisfy the coverage, C then

\[
S=S \cup (\sum \text{of the offspring})
\]

Break

End if

End for

Mutate some offspring in the new generation List
Until satisfy C or reach maximum iteration
End for

VI. RESULTS AND ANALYSIS

6.1 Network Parameters

<table>
<thead>
<tr>
<th>SIMULATION PARAMETERS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>COVERAGE AREA</td>
<td>1000m x 1000m</td>
</tr>
<tr>
<td>PROTOCOLS</td>
<td>AODV</td>
</tr>
<tr>
<td>NUMBER OF NODES</td>
<td>20</td>
</tr>
<tr>
<td>SIMULATION TIME</td>
<td>50 seconds</td>
</tr>
<tr>
<td>TRANSMISSION RANGE</td>
<td>250m</td>
</tr>
<tr>
<td>MOBILITY MODEL</td>
<td>RANDOM WAY POINT MODEL</td>
</tr>
<tr>
<td>LOAD</td>
<td>5 Kb-UDP Packets</td>
</tr>
<tr>
<td>MOBILITY SPEED</td>
<td>(4,8,0.5,1)Seconds</td>
</tr>
<tr>
<td>TRAFFIC TYPE</td>
<td>CBR,UDP,FTP,TCP</td>
</tr>
<tr>
<td>PACKET SIZE</td>
<td>512 Kbps</td>
</tr>
<tr>
<td>PAUSE TIME</td>
<td>10,20,30,40,50</td>
</tr>
</tbody>
</table>

6.2 Parameters

6.2.1 MAC Load
Mac load is the extra bytes that is required for secured path identification.

Macload=Packet Sent Size-Packet Received Size

6.2.2 Hop count
It is the time calculated at each hop. It is considered as Hop to Hop Delay.
Hop Count=Total Number of Hop for transmission of the data.

6.2.3 Data Transmitted
It means how much data has been transmitted from source to destination.

6.2.4 Residual Energy
It means how much energy is residual after the whole network has been used.
Residual Energy=total energy-energy dissipated.

VI. RESULTS

7.1 Hop Count

This graph shows the Hop Count comparison for both APTC and enhanced APTC based Technique. The enhanced APTC based technique is showing improvement. Less Hop Count will be required for transmission of the data from sensor node to the sink node.

7.2 Mac Load

This graph shows the MAC load comparison for the APTC and enhanced APTC based Technique. Enhanced APTC based technique has less MAC load compared to the APTC based Technique.

7.3 Data Transmitted

This graph shows the Data Transmitted comparison for both APTC and enhanced APTC based Technique.
This fig. 6 shows the Data transmitted comparison between APTC and Enhanced APTC based Technique. More data will be transmitted from the sensor node the base station because less number of Dead Nodes.

7.4 Residual Energy

This graph shows the comparison of the remaining energy comparison of APTC and enhanced APTC based technique. Enhanced APTC based has more remaining energy compared to the APTC based technique.

VIII. CONCLUSION

Articulation points based topology control is the best solution for the WSN for reducing the wastage of the energy. It reduces the total energy requirement for the transmission of the data from the sensor node to the sink node. Because the number of HOP is minimized. It helps in reducing the number of intermediate node as relay node. In enhanced APTC based technique the performance is further improved. By keeping multiple mobile sink nodes the sensor node waits for the sink node to come nearer so that less energy will be required for transmission of the data. All the performance parameter has shown the improvement. These parameters are Mac Load, Hop Count, remaining energy, data transmitted. So on the whole the network performance has been improved.

IX. FUTURE WORK

In current research enhanced articulation points based topology control based technique is used. In this technique basic aim was to reduce the energy dissipation and increase the life time of the nodes. in further researches more optimization based technique like Fuzzy can be used to enhance the performance further.

X. REFERENCES


