ENERGY EFFICIENCY IN WSN USING MOBILE SINK'S

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Abstract:
Modern communication is containing different types of wireless networks as backbone for various applications used for different users. Wireless sensor networks are remote networks and works in ad-hoc manner. Sensor collects the information sensed by them self and sends it to cluster head created in clusters. Further cluster heads use to send this information to the sink where data fetched use to complied and processed according to application used. To increase power efficiency to utilize energy much more effectively multiple mobile sinks are used along with base station. Mobile sink nodes are used to enhance the performance metrics. Multi-hop communication is used to form cluster head communication with other sensor nodes and concept is based on nearest sink available. Mobile sinks are configured manually according to the density of the nodes available for sensing purposes.

Keywords: *Wireless Sensor Nodes, Mobile Sink, Multi-hop Communication.*

1. Introduction

The consumption of energy in reception and sensing is independent from transmission distance. Energy consumption in computation is negligibly small compared to energy dissipation in other process such as sensing, transmission and reception of a bit as shown by Hoang and Motani [9]. Intra-cluster traffic can be varied if we change the size of the cluster accordingly by varying the number of nodes in a cluster. A change in a cluster size and the change in number of nodes will result in change in traffic load on a cluster head of that cluster. [10] If we increase the cluster size we can also accommodate more number of nodes. Therefore load on cluster head increases which may lead to depletion of the residual energy of the cluster head more rapidly and vice versa. Inter-cluster traffic means the data transfer between adjacent cluster heads on its way to the base station. The farthest cluster head from the base station have only its own data but the cluster head following it towards base station has to forward its own traffic and the traffic it received from its neighbor nodes. Thus, the cluster head which is nearest to BS will be dealing with maximum data traffic. Also larger the size of the cluster the cluster head requires higher energy to directly transmit or relay data to its adjacent cluster head on its path to the base station and smaller the size of the cluster , lesser will the amount of energy spent in transmitting it to the next hop cluster head or to the base station. We assume that energy spent at each node is consumed on reception and transmission only as energy spent on processing is negligible.[11]

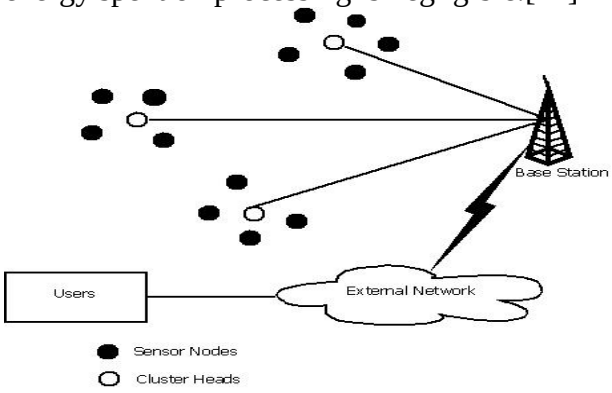

Fig 1:- Wireless Sensor Network [12]

2. AODV (Ad hoc On-demand Distance Vector)

AODV is an on-demand routing protocol [2]. The AODV algorithm gives an easy way to get change in the link situation. [3] If link failure occurred than notifications are sent only to the affected nodes within range in the network. Generally after receiving this notification, it cancels almost all the routes through this affected node. [7]

Generally maintenance of AODV process is based on timely updates which suggest that entries into AODV process expired after timer expires. Further updated information is passed to

the neighbors so that it can be updated about route breakage. Discovery of various routes from single source to various destinations is totally based on query and reply packets and intermediate nodes use logs to store the information of routes in route table. Various control messages which are used for the discovery and corrupted routes are as follows: [7] Route Request Message (RREQ), Route Reply Message (RREP), Route Error Message (RERR), HELLO Messages. [7]

Route Request (RREQ)

Various route request packet are flooded through the network when a route is not available for the destination from source. [3][4][5]

Pair source address and request ID identify RREQ and counter is incremented every time source node sends a new RREQ. [5][6] After receiving of request message, each node checks the request ID and source address pair. The new RREQ is discarded if there is already RREQ packet with same pair of parameters. [8]

Node with no routes information to particularly destination or any destination will be discarded and information is broadcasted to update information to other routes. [9]

A route reply (RREP) message is generated and sent back to source if a node has route with sequence number greater than or equal to that of RREQ.

Route Reply (RREP)

On having a valid route to the destination or if the node is destination, a RREP message is sent to the source by the node. [10]

Route Error Message (RERR)

The neighborhood nodes are monitored. When a route that is active is lost, the neighborhood nodes are notified by route error message (RERR) on both sides of link. [6]

3. Problem Definition

Wireless sensor networks are remote networks and works in ad-hoc manner. Sensor collects the information sensed by them self and sends it to cluster head created in clusters. Further cluster heads use to send this information to the sink where data fetched use to complied and processed according to application used. In our research, we will propose a cluster based novel multi-hop stable election protocol extended which does multi-hop communication between CHs and sensor nodes towards the sink. To increase power efficiency to utilize energy much more effectively multiple mobile sinks are used along with base station. Mobile sink nodes are used to enhance the performance metrics. Multi-hop communication is used to form cluster head communication with other sensor nodes and concept is based on nearest sink available. If sink is available nearer than cluster head then data will sent to sink and if cluster head is present nearer more than sink then communication will be done with cluster head. Mobile sinks will be configured manually according to the density of the nodes available for sensing purposes. For example we can place number of mobile sinks for two clusters which includes 15 nodes each. Cluster heads will based on routing protocol will send the information to the nearest mobile heads available. Further in future, mobile sinks can be used for authentication processes also.

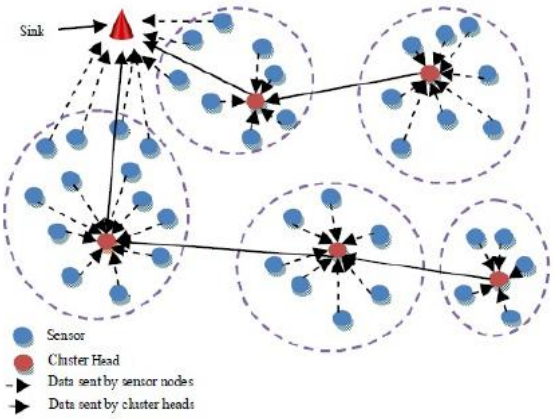

Fig 2:- Multi-hop Communication [13]

4. Objectives

To fulfill our require experimentation we will have following objectives

- To enhance the performance of the wireless sensor network.
- To reduce the effect of the congestion on the WSN by mobile sink.
- Comparison of congestion network and mobile sink network.

5. Proposed Work

Our research start with study of sensor network implementation and proceed with saving energy for sensors in following steps.

1st Phase: This phase contain the basic functionality and collection of information (simulator, basic sensor functions etc). Layout for comparison will be done in this phase.

2nd Phase: In this phase we implement a simple scenario for sensor nodes and divide the grid area into equal parts. Sensing process start with computation and communication later on.

3rd Phase: In this phase we implement the technique for mobile sink into grid area. Number of mobile sinks are based on the density of the nodes available for sensing purposes.

4th Phase: We implement the complete communication process for sensor network which works in different sense fields with mobile sink in very close to various cluster heads.

5th Phase: We compare the base scenario with proposed scenario for finding the difference and fetching the information about energy consumption.

6. Methodology

Congestion is decided by the communication scenario of the nodes as shown in the animation simulation. Number of nodes in the animation stuck to each other due to congestion.

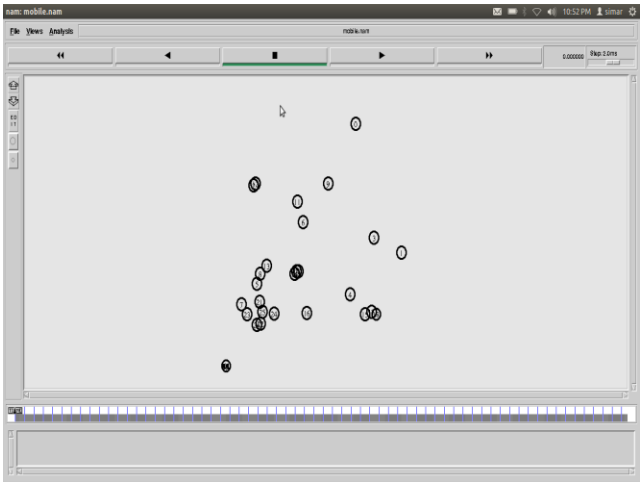

Fig 3:- Nodes at time 0

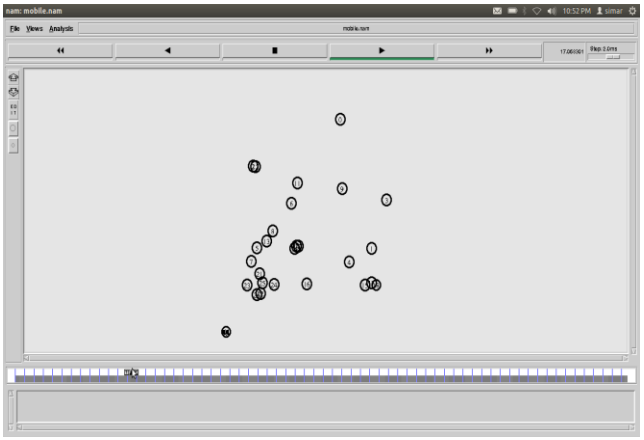

Fig 4:- Nodes at time 17

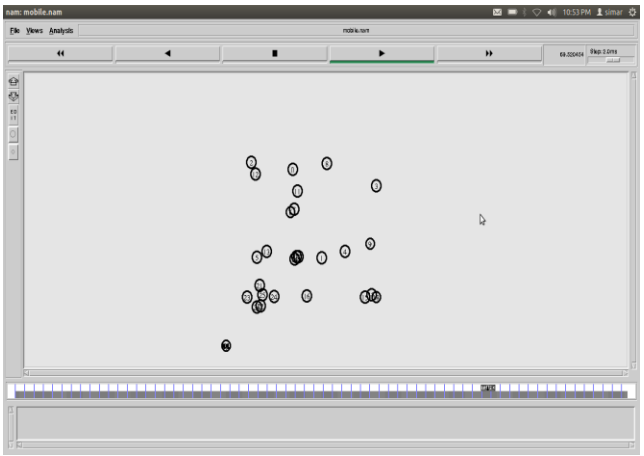

Fig 5:- Nodes at time 70

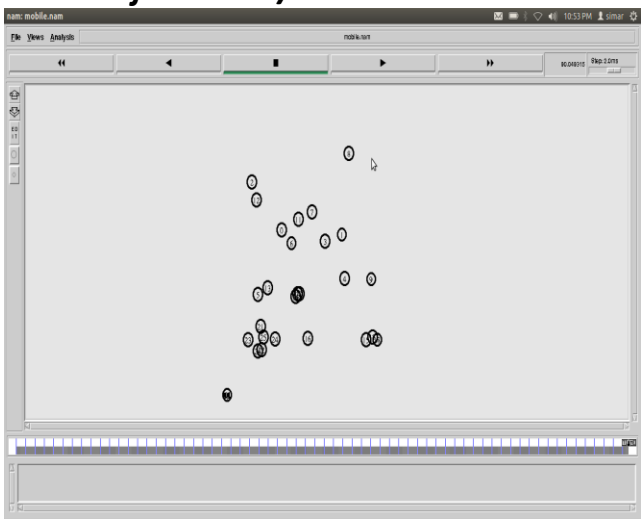

Fig 6:- Nodes at end (at time 90)

Alive nodes are more without congestion scenario and in case of congestion; number of alive nodes tends to decrease generally due to non availability of the resources.

PARAMETERS	CONGESTION RATIO	SOLUTION (MOBILE SINK)
ALIVE NODES	400	455
THROUGHPUT	6600000 bits/sec	7200000 bits/sec

Sink is the aggregation point and every node sends data to sink. In case of every node sends data to sink, congestion is making which will reduce throughput of the network due to non availability of the resources.

Mobile sink is the concept to bring representative of sink which can be bring in to the simulation grid to fetch data from the normal nodes. When the distance of the nodes and the sink (in form of mobile sink) is less as compared to the normal communication of the nodes and sink then the congestion will be less. Moreover there are number of mobile sink according to the density of the network. Number of mobile sink can move in sensing grid for providing flexibility to nodes for energy saving. Distribution of the total data from sensing nodes to various mobile sink will decrease the congestion as the information sending from nodes to main sink in quite low in case of mobile sink.

7. Experimentation

Basic parameters used for experimentation for checking the behavior mobile sinks are given below:

Parameters	Values
Simulator	NetworkSimulator
Simulation Time	90
No of nodes	100
Routing Protocol	AODV
Traffic Model	CBR
Min Delay	10 us
Packet Size	512

Results obtained for normal performance of multi-hop communication and mobile sink, comparison of multi-hop communication and mobile sink, Performance of alive nodes, comparison of alive nodes and rounds.

Performance of multi-hop communication and mobile sink communication

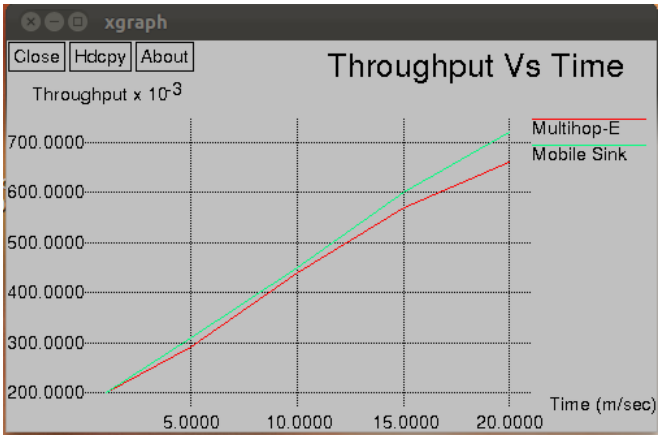

Figure 7: Throughput v/s time comparison of multi-hop and mobile sink communication

The performance of network is compared in above figure and it show that the green line of the throughput for mobile sink communication. Red line shows the throughput in case of multi-hop communication. It is clear from the graph that throughput in the case of mobile sink is more than from multi-hop communication.

Performance of Alive Nodes with respect to rounds

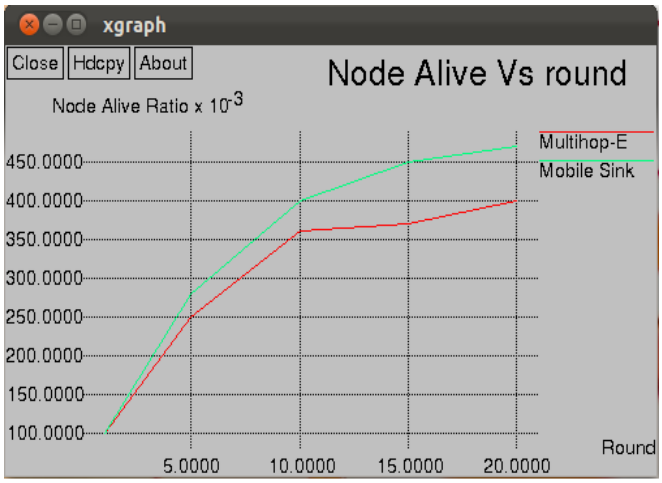

Figure 8: Alive Nodes with respect to rounds starts from 100 nodes and 0 round

The performance of network is compared in above figure and it show the alive nodes v/s rounds for multi-hop and mobile sink communication with 100 nodes and starts from 0 round. Green line shows the alive node ratio for mobile sink and red line shows the alive node ratio for multi-hop. It is clear from the graph that ratio of alive nodes in case of mobile sink is more than from multi-hop.

7. Conclusion

In this work, the performance of the Mobile Sink has been summarized. The main focus is to show the performance of the multi-hop communication and mobile sink communication. The throughput in the case of mobile sink is more than from the throughput in the case of multi-hop communication. In the case of multi-hop communication, nodes which are closer to the sink sends data directly to the sink, remaining nodes sends the data to the desired cluster heads. So, there is a chance of congestion. But in mobile sink clusters/ cluster heads sends data to the mobile sink, which the sends data to base station. So, there is no any chance of congestion because mobile sinks are synchronized with each other. In the case of mobile sink alive node ratio is more than from the multi-hop communication. In the case of mobile sink the congestion is less so loss of energy is less and nodes alive for more time but in multi-hop congestion are more, energy loss is more so, alive time for nodes are less.

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