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An Efficient Energy Utilization Using Routing Protocols In Heterogeneous Wireless Sensor Networks

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Abstract: In multihop communications, nodes that are near a sink tend to become congested as they are responsible for forwarding information from nodes that are farther away. Thus, the closer a sensor node is to a sink, the faster its battery runs out, whereas those farther away may maintain more than 90% of their initial energy. Energy consumption becomes a primary concern in a Wireless Sensor Network. To pursue high energy saving at sensor nodes, a multi mobile collector should traverse the transmission range of each sensor in the field such that each data packet can be directly transmitted to the mobile collector without any relay in heterogeneous WSN. And data packets can be relayed through nodes if packet has emergency info.

Key words: Energy, WSN, mobile sink, battery, transmission range.

1. INTRODUCTION

Owing to the rapid advances in wireless communications and micro electro mechanical systems technologies, the micro sensor technologies have improved in terms of size, cost, sensitivity, and variety. However, we note that the sensor nodes are still very limited in computational capacities, memory and power. Hence, the routing algorithm of the network should be designed to be energy efficient allowing for the maximal lifetime of the network. Routing algorithms can be broadly divided into two categories are namely direct routing and indirect routing using a cluster approach. In direct routing algorithms [1, 2], each sensor node directly transmits the acquired data to the base station (BS). Conversely, indirect routing algorithms [3] involve a clustering algorithm that creates multiple clusters of sensor nodes. These clusters elect a cluster header (CH) node within a cluster. Under this configuration, each sensor node transmits the acquired

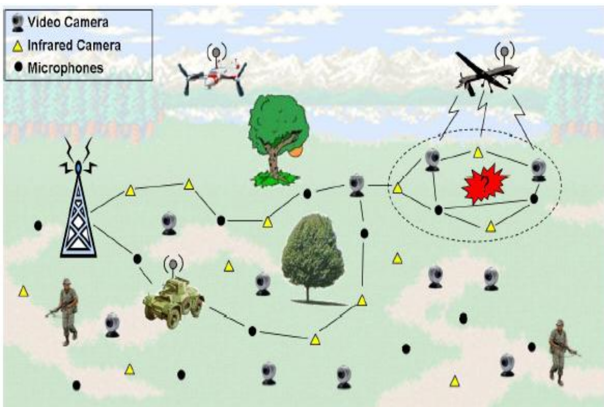

Fig.1 Wireless sensor network

In clustering technique, data transmission is more reliable. But in this some unnecessary energy loss will occur in intermediate cluster head while no own data transmission.

2. RELATED WORK

In [1], author proposed a new energy-efficient approach for clustering nodes in ad hoc sensor networks. Based on Hybrid Energy-Efficient Distributed clustering, that periodically selects cluster heads according to a hybrid of their residual energy and secondary parameter, such as nude proximity to its neighbors or node degree. This approach can be applied to the design of several types of sensor network protocols that require energy efficiency, scalability, prolonged network lifetime, and load balancing. In **[2]**, the author first present how to place SNs by use of a minimal number to maximize the coverage area when the communication radius of the SN is not less than the sensing radius, which results in the application of regular topology to WSNs deployment. Mobile node rotation can extend WSN topology lifetime. It considers WSNs that are mostly static with a small number of mobile relays not practically declared for Dynamic WSNs. **[3]** Deals with mobile data gathering, which employs one or more mobile collectors that are robots or vehicles equipped with powerful transceivers and batteries. An important issue is not addressed in this paper, i.e. latency.

In **[4]** author presented the design and analysis of novel protocols that can dynamically configure a network to achieve guaranteed degrees of coverage and connectivity. This work differs from existing connectivity or coverage maintenance protocols in several key ways. Capability of

authors protocols to provide guaranteed coverage and connectivity configurations through both geometric analysis and extensive simulations. It is not extending solution to handle more sophisticated coverage models and connectivity configuration and develop adaptive coverage reconfiguration for energy-efficient distributed detection and tracking techniques.
In [5] paper author have developed an embedded networked sensor architecture that merges sensing and articulation with adaptive algorithms that are responsive to both variability in environmental phenomena discovered by the mobile sensors and to discrete events discovered by static sensors. They also showed relationship among sampling methods, event arrival rate, and sampling performance are presented. Sensing diversity does not introduce which is used to enhance Fidelity Driven Sampling.

3. PROPOSED WORK

In this paper, we propose the technique to collect the data from multiple sensors or polling point through the mobile collector. In our base work we have considered the reduction of tour length by increasing the multiple mobile collectors. And our enhancement work we propose the solution for collecting the data via multihop communication for emergency data to avoid the data collection delay in a heterogeneous WSN. And in our proposed work we have used multiple mobile collector to collect the data.

3.1. Algorithm

Network Deployment Algorithm

Deploy the nodes in same/random place.

- For each node
  - Update own position information
  - Send the hello message with the position information

- **Receive hello message**
  - Update own position
  - Check the dist from hello sender (dist)

If less then Th
Calc future position
Set temp_pos = current pos
Set future_pos = temp_pos+/- (dist/2)
Start the node movement to future_pos
1) If node has data to transfer to destination node
a. Check the routing table
i. If route found
ii. If route not found
1. Send the data
2. Start counting data
3. At beginning of data count set the timer to check the counting
a. Generate the req as normal on demand routing protocol
b. Update the request with own id
c. Broadcast to all neighbor to find destination
2) If Req received
a. Checks req is new
i. If not
ii. If yes
1. Ignore
1. Updates the reveres route
2. Updates the id information
3. Checks node is the destination
a. If yes
. If not
i. Generate the rep with own id
i. Forward the packet further to all

Step1: Multi hop data gathering
Step2: S -) s1,s2,s3…….sn (Number of Sensor Nodes);WC-> w1,w2,w3..wn (Weighted count)
Step3: if (s want to send the data to BS)
{
Select a multi hop route for data forwarding
}
if (route failed)
{
Again search next available route for data forwarding
}
step4: In multi hop communication, we have create RP--> R
Step5: RP can collect the data from sensor, when RP within the transmission range
If {Energy > Threshold level} {
Send data to RP} else
{
Send it Senscar
}

Step6:Senscar Travelled through RP
Analyze all weighted count i.e., w1=30,w2=45,w3=50
Analyze distance from RP to Base staion via
[expr sqrt(pow(($x2-$x1),2)+pow(($y2-$y1),2))]
3. Data transfer rate i.e., DT
4. Sorting occurs depending on
if (WC>max && distance>long&&data rate>higher)
5. Depending Ranking collector can move and collect data

Step 1: Initial setup is to design the network as less hop count transmission.
Step 2: design the pp from senor devices. "Here we are setting PP can receive the data from number of nodes"
Step3: if sensor having the data, then sensor finding the PP, which is near to that sensor.
Step 4: if sensor found any PP point node is available then transfers data to PP
Step 5: if PP has more data then it informs to control station.
Step 6: control station receives the number of control information from different PP's.
Step 7: after collecting the control message, CS makes the shortest route to collect the data from PP's.
Step 8: no of MC moves towards each PP's and collects the info and returns back to CS based on requirements'

3.2. Modules

To improve our proposed system implementation we have divided our proposed work into small modules
a) Analyzing the data sink details
b) Setting less hop count transmission
1. Problem in static forward node
2. Dynamic forward node
c) Select sensor as pp
1. Static P
2. Dynamic PP
d) Find and collect data from pp
e) Handover the data o BS

3.2.1. Analyzing the data sink details

Handover the data to data sink when data sink within the transmission coverage area of sensors. The sensors which are located in the range of data sink it transforms all the information to the data sink with minimum hops.

3.2.2. Setting Less Hop Count Transmission

Multi-hop routing, packets have to experience multiple relays before reaching the data sink. Minimizing energy consumption on the forwarding path does not necessarily prolong network lifetime as some popular sensors on the path. So to avoid the problem in multi-hop routing we are setting the less hop count transmission.

3.2.3. Static forward node

When the node forwarding the data continuously, then that node will loss more energy. It may causes node failure.

3.2.4. Dynamic forward node

If the forward node is dynamically changed with less hop count node then energy loss of node should be very less. So, in the first path the hop count is 3 where as the Hop County for the second path is 2, therefore for data transmission the preferable path is second path.

Select Sensor As PP:

A subset of sensors will be selected as the polling points, each aggregating the local data from its affiliated sensors within a certain number of relay hops. These PPs will temporarily cache the data and upload them to the mobile collector when it arrives. The PPs can simply be a subset of sensors in the network or some other special devices, such as storage nodes with larger memory and more battery power.

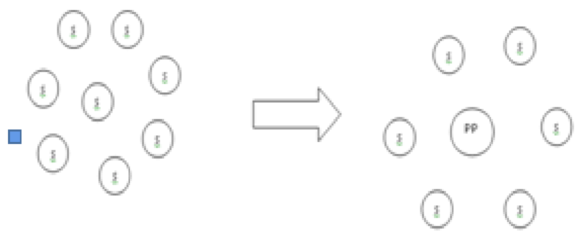

Fig.2: Group of sensors with polling point

From a group of sensors one sensor will be elected as a polling point, which receives and send the information to the sensors.

Find and Collect Data from PP's:

Since the mobile collector has the freedom to move to any location in the sensing field, it provides an opportunity to plan an optimal tour for it. Our basic idea is to find a set of special nodes referred to as PPs in the network and determine the tour of the mobile collector by visiting each PP in a specific sequence. When the mobile collector arrives, it polls each PP to request data uploading. And then upload the data to Mc. The Polling points collect the information from all the sensors and that aggregated information is collected by the Mobile collector.
The base station desires the data collection path to the mobile collector. The base station has to calculate the tour length for the mobile collector. if the mobile collector tour length is more than threshold then the base station need to plan for one more mobile collector. so the mobile collector tour length will be remain always till the threshold value.

Handover the Data to BS:

A PP uploads data packets to the mobile collector in a single hop. The mobile collector starts its tour from the static data sink, which is located either inside or outside the sensing field, collects data packets at the PPs and then returns the data to the data sink.

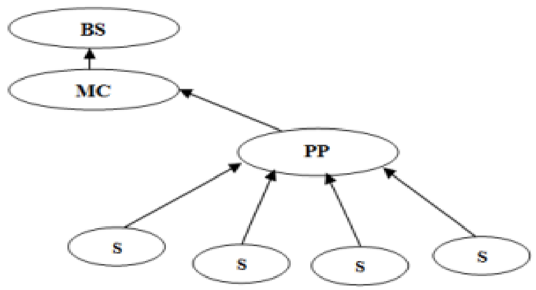

Fig.3: Hierarchy of sensors

S-sensor
PP-polling point
MC-Mobile collector
BS-Base Station
-Finally MC Handover the data to data sink, such as BS.
The mobile collector can share the data directly to BS or else other mobile collector to relay the data to base station to improve the data delivery.
The Mobile collectors move through all the polling points and collect the information and send it to Base Station.

TABLE .1 SIMULATION PARAMETERS

S.NO	parameters	scenario
1	Simulation area	500mx500m
2	Routing protocol	LEACH,AODV
3	Total sensor nodes	100 nodes
4	Sink node	1 Node
5	Packet type	CBR
6	Type of sensor node	Static &dynamic
7	Sensing range	30m
8	No. cluster heads	6 Nodes

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9	Packet size	700 Bytes
10	Packets transmitted	20000 bytes
11	Antenna type	Omni-directional

4. RESULTS

We did our research analysis in WSN by using NS2. In Ns2 we can show two type of output, one is Nam window and another one is X-graph.
In this paper, we showed our model testing output. From this model result, we can conclude our proposed method is more than previous one.

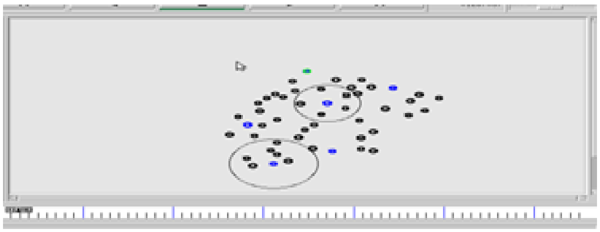

Fig.4: Clustering formation in WSN

From the above figure deployment of nodes and cluster head selection and clustering formation is takes place. And base station is deployed. And which contains totally 50nodes, and the range of each node is 30m, and type antenna used in WSN Omni-directional and deployment of nodes are located in NAM window.

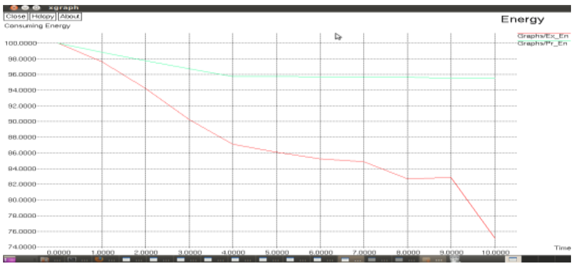

Fig.5: Energy comparison b/n proposed and existing

From this model result, we improved energy level in heterogeneous WSN and we reduced the energy consumption compared to homogeneous WSN.

Packet delivery performance:
It is calculated as the ratio of the number of distinct packets received at sinks to the number originally sent from source sensors.

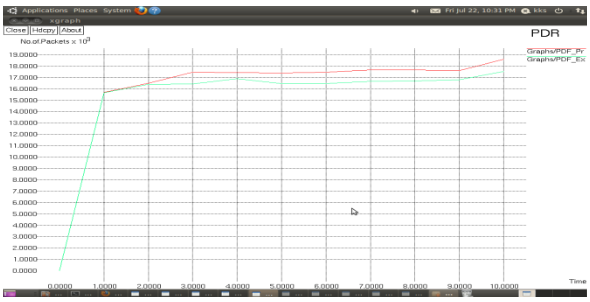

Fig.6: packet delivery comparison b/w proposed and existing

This metric indicates the reliability of data delivery. From the figure it is evident, we improved packet delivery ratio compared to existing system.

DELAY COMPARISION:
This metric is calculated as the average one-way latency that is observed between the transmission and reception of a data packet at the sink. This metric measures the temporal accuracy of a packet.

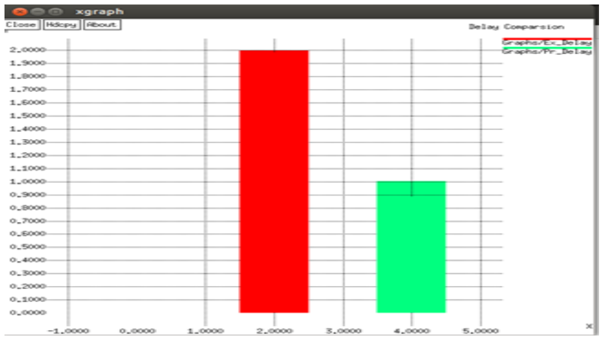

Fig.7: Delay comparison b/w proposed and existing

From the above result it is evident that, we reduce the delay compared to existing system.

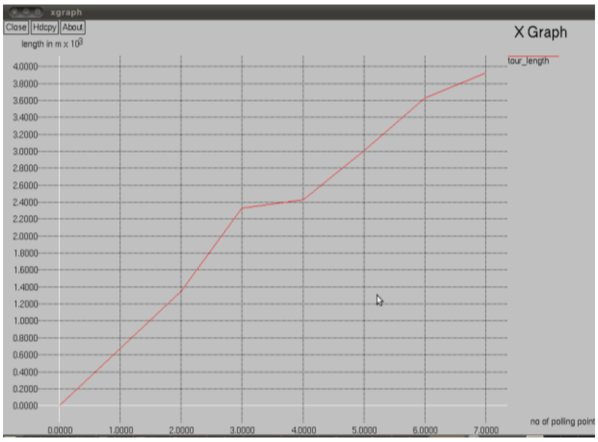

Fig. 8: Data collection by mobile collector with time

From the figure it is evident that amount of distance travelled by the mobile collector is 4000m.the important advantage of mobile collector concept is to decrease the propagation delay i.e. it is directly communicated to the base station and reduction of relay nodes also.

The data collection method is used to collect the aggregate data from the sensor node to the base station. The main object of the data collection [15] process is to reduce the delay and improves the network's lifetime and to find polling points and compatible pairs for each cluster. Then carry out the achievement of optimal overall spatial diversity and to schedule uploading from multiple clusters. By properly selecting polling points in each cluster SenCar can powerfully gather data from cluster heads and transport the data to the static data sink. The following Fig.6 describes experimental result for proposed system aggregation scheme analyses are shown.

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Table.2 Comparison between Homogeneous and heterogeneous WSN

S. No	Parameters	Homogeneous WSN	Heterogeneous WSN
1	Size of WSN	500mx500m	500mx500m
2	Type of Node	Stationary	Dynamic
3	Total Nodes	50	50
4	Routing Protocol	LEACH	LEACH (AODV)
5	Type of Antenna	Omni-Directional	Omni-Directional
6	PDR value	17.5X1000 Packets	18.5X1000 Packets
7	Initial Energy	100J	100J
8	Energy Consumption	25 J	05 J
9	Propagation Delay	2 s	1 s

5. CONCLUSION

In this paper, we studied mobile data collection in wireless sensor networks by researching the tradeoff between the relay hop count of sensors for local data aggregation and the travel length of the mobile data aggregator. We proposed a polling-based scheme and formulated it into the problem, then presented two efficient algorithms to give practically good results. Extensive simulations have been carried out to validate the efficiency of the system. And priority data delivered in time through the relay nodes. In our future work we have to study mobile collector method to recover the failed sensor node.

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BIOGRAPHIES

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