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Enhanced perimeter routing under greedy approach for energy efficiency

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Abstract: Parameter based routing is becoming an advantageous technique over topological based routing due to enhancement in energy constraint. This paper has focus on reliable positioning of nodes based on grid network architecture to handle the traffic congestion with the help of energy model. This enhanced greedy approach take decisions regarding route forwarding through perimeter region. This work has aim to evaluate the performance with high mobility quality in the network. Our work has focused on the varying effects of network parameters set at different conditions such as packet throughput ratio, speed, average throughput in kbps, delay tolerance, data load in packets per second and region coverage. The simulation results indicate that the packet throughput ratio of enhanced greedy approach has improved by 10% over greedy approach in the presence of 40% of malicious nodes in the wireless network. Our aim is also to make the enhanced perimeter routing more balance to prolong the network life time.

Keywords: routing; energy model; mobility; throughput; wireless network

I. Introduction

The ground of wireless sensing network is composed of nodes with mobility through infrastructure-less building. Now-a-days flexible computing is an on-demand issue in the battle-field situations. This really requires the vision of highly connected networking in terms of routing on the field to handle the immediate current situations for military purposes. So time demands to do work on routing because of flexible scenario on battlefield [1]. It makes routing a challenging as well as on demand task. This is the reason for routing techniques to move towards the positioning based rather than topological based scenario [2]. As topological based routing consumes more power and take enough time to proceed on geographic area. To make the network flexible, it is highly required to control the flow of packets overhead.

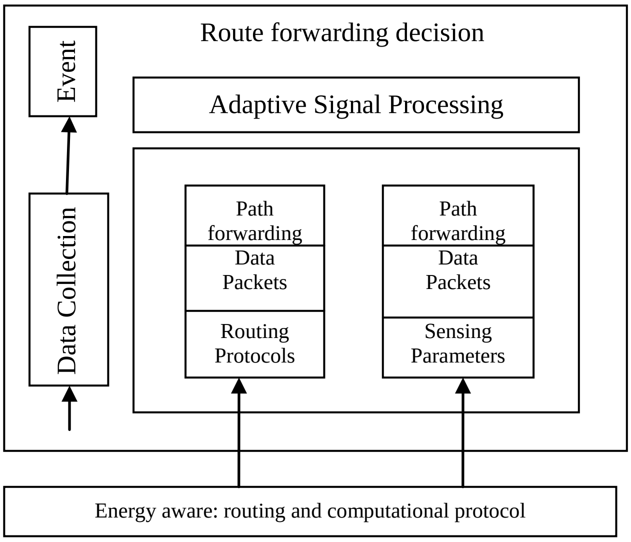

Fig.1 Energy efficient sensor network (EESN)

Figure 1 reflects the number of modules in an energy efficient sensor network. The final goal of EESN is to take decision based on data packets fused from different sensor inputs. On the hierarchy, the data forwarding done from lowest level of selected particular routing protocol. Adaptive signal processing is used on top for proper time synchronization. Time synchronization is used from data collection to event formulation level [3].

Energy saving is a crucial challenge in networks under sensing technology, as the replacement of battery is not cheap in unreachable deployed regions [4]. It can be done through efficient time allotment between active and sleep mode. So it is necessary to keep the radio in sleep mode when there is no informatics data to travel between sender and receiver. It will results in minimum energy consumption in the network. At deepest sleep interval, which switch off the voltage regulator and oscillator, gives the minimum current flow among low power modes with higher energy cost. On the contrary to this, a lightest sleep mode interval draws higher current flow with lesser energy cost. So, it is better to implement the deep sleep mode during heavy traffic data.

II. Perimeter Routing

In this routing technique, a forwarding node finds out the set of all other neighboring nodes. The nodes that are in selective mode should be closer to the destination than itself. The next neighbor node having maximum weight value will select the next hop mode towards the receiver [5]. This process is continuously repeated at each hop under greedy forwarding approach.

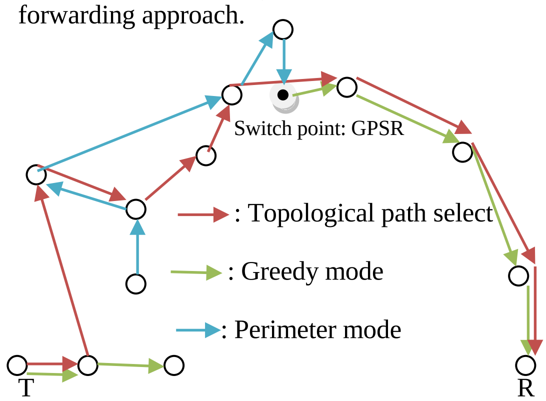

Fig.2 Perimeter routing under path differentiation

Figure 2 shows that the path following selection on the basis of topological selection (red), greedy mode (green) and perimeter mode (blue). This routing is mainly based on location and distance of neighboring nodes. Next, one hop information data is saved before taking decision to the next hop count. The main advantage of using greedy approach is the removal of dead nodes in the network. To forward the packets in the network, right hand propagation rule is applied under protocol configuration. To minimize the crossings among communication lines, planarization graph technique is adopted. The table1 declares the perimeter header that contain the fields D_p L N_f E^t $M_{G/P}$.

Table 1 Perimeter header

Field	Function
D_p	Destination point
L	Location perimeter mode
N_f	First node position
E^t	First edge traversed
$M_{G/P}$	Mode (greedy/perimeter)

III. ENERGY MODEL

A. *Analytical Equations*

Energy model proposed the energy components used in the direction of total power consumption at a node. Here we use the single-hop sampling time.

a. On-Listen energy: This energy is defined as when the active transition mode of radio is on but there is no transmission and reception of any packets.

$$E_L = \frac{S_p}{C_k} * T_c * I_l * V$$

Under this, S_p is the sampling period taken between the nodes, T_c is time period during awaking mode, I_l is the current drawn during listen period, C_k is the clock time period, V is the total voltage drawn.

b. Switch on-off energy: This energy is calculated in between the states of normal, power off and idle condition.

$$E_S = \frac{[(I_a) - I_S] * T_{SA} * V}{2}$$

In this, I_a is the current drawn in active mode, I_S is the current drawn during sleep mode and T_{SA} is the time gap between sleep mode and active mode.

c. Transmit energy: It compute the total number of data packets sent inside the radio.

$$E_{Tr} = P_{lt} * P_S * T_{Byte} * I_T * V$$

In this, P_{lt} includes the total packet data length, P_S is the total number of packets sent, T_{Byte} is the byte time data, I_T is the current drawn at transmission mode.

d. Receive energy: It is used to calculate the overall energy received at the end of the network.

$$E_R = P_R * P_{lt} * T_{Byte} * I_R * V$$

In this, P_R is the total power received and I_R is the current drawn at receiving mode.

e. Sleep energy: This energy is computed at low power mode.

$$E_S = T_{off} * I_S * V$$

In this, T_{off} is the off time period at sleep mode and I_S is the current drawn at sleep condition.

f. Total energy drawn: The total energy includes the all energy factors described above as:

$$E_T = E_L * E_S * E_{Tr} * E_R * E_S$$

So the energy model is used to evaluate the energy consumption in an efficient way to control the wastage and to enhance the energy saving.

B. *Greedy approach algorithm*

Here, in this algorithm we assume that (N_d:K_d) are the regions of the destination point node ‘d’ and the forward region node ‘f’ that have the responsibility to take data to the destination point ‘d’. Figure3 elaborates the code algorithm for greedy approach.

The forwarding region node ‘f’ computes the distance area between and destination node 'd’ and itself. It also calculates the distance between destination node and its neighboring nodes [6]. In the formulation accepted, for example, is ‘L’ node of forwarding region is closer to the destination point then the difference between ‘f’ and ‘d’ and distance between ‘L’ and ‘d’ is computed and then divided by the distance between ‘f’ and ‘d’. If the closer proximity formulation is not fulfilled then the algorithm will need to move towards the perimeter mode.

The above algorithm elaborates as:

```
Input; f: Forward region node, d: Destination point, (N): Neighbor-listing
Variables: Route (f, L) where L ε neighbor list (N)
Output: Next-Hop-count-node: if greedy approach accepted successfully
NULL: if Greedy approach is not adopted and need of perimeter mode.
Initial / Next-Hop-count-node= NULL
Progress → 0.00
Begin Greedy algorithm
        D1: Distance between ‘f’ and‘d’=
        √((N_f − N_d)^2 − (K_f − K_d)^2)
        D2: Distance between ‘L’ and‘d’=
        √((N_L − N_d)^2 − (K_L − K_d)^2)
If (D2 <D1) then
Route (f: L) = (D1−D2)/D1
If (Destination progress < Progress (f: L))
Then
Destination progress = Progress (f: L)
Next-Hop- ← L
Count node
End if
End if
End for
If (Required destination progress > 0.0) then
Return Next-Hop count node /;
Greedy approach is adopted
Else
Return Null /; perimeter mode is adopted
End if
End; Greedy approach algorithm
```

Fig.3 Pseudo code: Greedy approach

C. *Enhanced greedy approach algorithm*

In this, we illustrate a number of sets of candidates among neighboring nodes. Figure 4 elaborates the code algorithm for enhanced greedy approach.

Candidate-list (N): A subset of neighbor listing (N)
For each neighbor L ∈ neighbor- listing (N)
Here is a variable weight (w) is computed as the summation of initial energy at L known as 'residual energy factor' (w). The region covered with the appropriate selection of 'w' is known as progress (f, w), which resembles the difference between 'f' and 'd' and distance between 'w' and 'd' divided by the difference between 'f' and 'd'. Under this selection, the node with the maximum weight value is selected for the next-hop-count under routing. If 'f' will not be able to get any neighbor node then candidate list is having value '0' and the route will go under perimeter mode.

Input; f: Forward region node, d: Destination point, (N): Neighbor listing
Variables: Route (f, L) where L ∈ neighbor listing (N), Residual energy factor (W)
L ∈ candidate list (N), corresponds to maximum-weight value 'w'
Output: Next–hop-count-node// if Greedy approach: success
NULL: if Greedy approach: unsuccessful// Need of Perimeter mode.
Initial/ Next-hop-count-node=Null;
Maximum weight value ←0.00
Candidate list (N) ←ψ
Begin
Enhanced greedy approach
Distance covered between 'f' and'd' =

$$\sqrt{(N_f - N_d)^2 - (K_f - K_d)^2}$$

For each neighbor node L ε neighbor listing (N) do
Distance between 'L' and 'd' =

$$\sqrt{(N_f - N_d)^2 + (K_f - K_d)^2}$$

If distance between 'L' and 'd' is less than the distance between 'f' and 'd' then
Candidate list (N) ← Candidate list (N) U {L}
End if
End for
For each node at L ε candidate list (N) do
Residual energy factor (w) = $\frac{Energy\ at\ (w)}{Energy\ at\ initial\ point\ (w)}$
Route (f, L) = $\frac{Distan\,ce\ between\ f\ \&\ d - distance\ between\ L\ \&\ d}{Distance\ between\ f\ \&\ d}$
Weight (w) ε Residual energy factor (w) + Route (f, L)
If (weight at maximum value < weight (w)) then
Maximum weight function = weight value (w)
L ← Next-hop-count
End if
End for
If (maximum value at 'w' > 0.00) then
Return
Next-hop-count-mode
Else
Return null
End if
End- Enhanced Greedy approach algorithm

Fig.4 Pseudo code: Enhanced Greedy approach

With the above description in comparison with the greedy approach, the selection of next-neighbor-node among listing depends upon the larger residual energy with the near-far effect. So, it will have the advantage to decrease the failure time of first node hop and will relatively give help in the enhancement of life-time of the network.

In further, the computation needs that the speed of the node must matches with the direction of route adopted in the enhanced greedy approach.

IV. Simulation Metrics

A. We have done simulation of enhanced greedy approach in network simulator-3 in comparison with the greedy approach.

Under simulation environment, the parameters taken are shown in table2 as:-

Table 2 Simulation environment

Simulator	NS-3
Area	900 * 900
Transmission range	300m
Number of nodes	150
Pause time duration	0.5 sec.
Simulation time	200 sec.
Packet size	560 Bytes
CBR rate flow	10kbps
CBR destinations	5
Beacon time gap	0.6 sec.

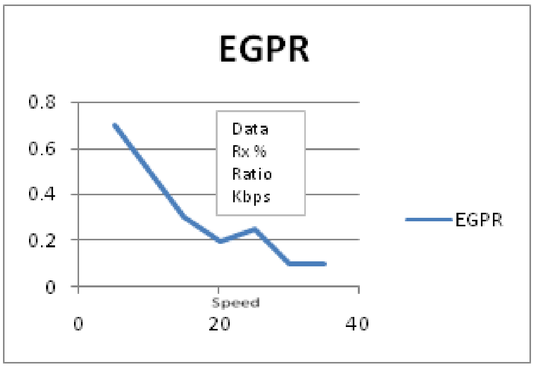

Fig.5 Packet throughput (kbps) VS Speed (m/s)-EGPR

Fig.6 Packet throughput (kbps) VS Speed (m/s)-GPR

Under static conditions for 10 different region points, we have observed the EGPR & GPR using parameters data received ratio (%) in kbps, speed in (m/s), acceleration and routing overload. We observe from Figure 4 that at the speed of 10 m/s the data received ratio is 50 in kbps and from Figure 5 the data received ratio is 30 in kbps at the same speed. So, this is the observed enhancement of greedy perimeter approach over greedy perimeter approach.

It is also observed that as the speed increases data throughput decreases because of the overloaded data on receiver side. Still we are having improvement in enhanced mode rather than in GPR. As the data received ratio is increased in EGPR at 15m/s by 10% as in comparison with the GPR at the identical conditions.

B. Load affect during packets send:

From figure 7 and figure 8, we observed that the average throughput VS packets sent per second increases at the rate of 10%. The number of packets increases at the same region in EGPR due to minimize the overhead in path routing. By selecting the appropriate route selection in enhanced mode, maximum data is sent through EGPR than GPR.

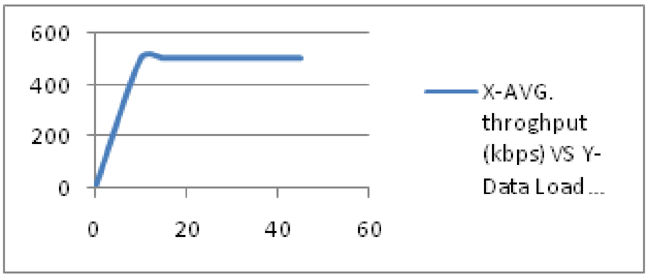

Fig. 7 EGPR: Data rate

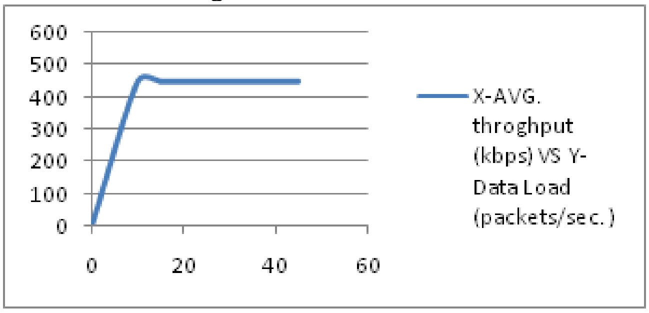

Fig. 8 GPR: Data rate

V. CONCLUSION

In this paper, we proved that the enhancement in greedy approach through appropriate energy modeling in route selection. The results shows that technique used in our routing protocol gives better results in terms of data received ratio, throughput and packets sent per second. Our main focus is on route stability during packets sent and to minimize the congestion over head.

VI. REFERENCES

[1] T. Canli and A. Khokhar, “Pipelined Routing Enhancement MAC Protocol for Wireless Sensor Networks”. In THE 2009 IEEE International Conference on Communications (ICC09), pages 86-90, Dresden, Germany, June 2009.

[2] Hongbin Chen, Chik.Tse, and Tiuchao Feng, “Impact of Topology on Performance and Energy Efficiency in Wireless Sensor Networks for Source Extraction”. IEEE Transactions on Parallel And Distributed Systems, Vol.20, No.6, June 2009.

[3] G. C. Gautam, T.P. Sharma, 2011 “ A Comparative Study of Time Synchronization Protocols in Wireless Sensor Networks”, International Journal of Applied Engineering Research, DINDIGUL Volume 1, No 4.

[4] F. Ashraf, R. Crepadi and R. Kravets. Know Your Neighborhood. “A Strategy for Energy-Efficient Communication”. In IEEE Seventh International Conference on Module Ad Hoc and Sensor Systems (MASS10), pages 392-401, San Francisco, CA, November 2010.

[5] Wu, S., Candan, K: GPER: “Geographic Power Efficient Routing in Sensor Network”. In. Proceeding of Int’l Conference Network Protocols (ICNP), pp. 161-172. IEEE, Los Alamitos (2004).

[6] A. Anwar and L. Lavagno. “Energy and Throughput Optimization of a Zigbee-Compatible MAC Protocol for Wireless Sensor Networks”. In Seventh International Symposium on Communication Systems Networks and Digital Signal Processing (CSNDSP 10), pages 305-310, Newcastle upon Tyne, England, July 2010.