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A PATH FOR HORIZING YOUR INNOVATIVE WORK

SLEEP SCHEDULING FOR GEOGRAPHIC ROUTING IN DUTY CYCLED MOBILE SENSOR NETWORKS

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Abstract*:* In this paper we find the optimal path from source to destination node in a Duty Cycled Mobile sensor Network with Geographic routing. Geographic routing is one of the most promising techniques due to its simplicity, scalability, and efficiency. The WSN networks employing duty cycle technique in geographic routing has a task to find out the path from sensor to Base Station of the network to send the sensed data. GCKN(Geographic connected k neighbor) sleep scheduling overcome this geographic routing designed for static WSN. We propose a scheme where other node parameters like delays incurred and load on each node are calculated and are taken into consideration to

Keywords: Geographic Routing, Sleep Scheduling, Duty –Cycled Mobile Sensor Network, Network simulator-2 (NS2)

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INTRODUCTION

In recent year, a lot of research work has been proposed on routing scheme in WSN. Geographic routing is one of the most promising techniques due to its simplicity, scalability, and efficiency. We focus on sleep scheduling problems in duty cycle of node with geographic forwarding mechanism. In WSN, because of duty-cycled, latency issues arise and most of opportunistic routing protocols have been proposed to handle this problem by adjusting the geographic forwarding. GCKN sleep scheduling overcome existing geographic routing designed for static WSN. We are proposing a new scheme to minimize transient delay among node, resulting in reduce duty-cycle, low energy consumption and minimized network latency. Proposed system is designed by keeping the multipath broadcast methodology for data sinking for receiving end. This will create multiple path for transferring data from sender to receiver and every path and every node will auto decide to go in sleep and wake up state after communicating with each other. This will solve data flooding problem, improve network efficiency and save energy

Some advantages of geographic Routing are as follows:

 The mobility support can be facilitated. As each node sends its coordinates periodically, all its neighbors update their routing tables accordingly. Thus all nodes aware of its alive neighbor nodes.

 It is scalable. The size of routing table depends on network density not on network population. Hence wider networks consisting of thousands of nodes can be realized without cluster formation.

 Minimum overheads are introduced. All the interaction taking place in these network are localized. As the result bandwidth is economized. The processing and transmission energy is saved and the dimensions of routing table are decreased. Thus in this scheme the source sends a message to the geographic location of the destination instead of using the network address. In such a scheme determination of routing path from source to destination is done by forwarding the selected node at each intermediate node in a fully-distributed manner. Thus the the forwarding decision is determined purely on the basis of the location of each node and not on the basis of the network size, but now the research of Geographic routing has moved towards duty cycled wireless sensor networks (WSNs).

Duty Cycled WSN aims at reduction in use of power consumption In duty cycled WSN, according to some sleep scheduling algorithms some nodes are made to sleep and awake alternately. i.e It selects a subset of nodes to be awake in a given epoch while the remaining nodes are in the sleep state. Thus it leads to lesser power consumption.

Monitoring is a common application for WSNs. The WSN is deployed over a region where some phenomenon is to be monitored. This can be applied in the field of military where they use sensors to detect intruders. When the sensors detect the event being monitored, the event is reported to one of the base station then it takes appropriate action. As sensor nodes for event monitoring are expected to work for a long time without recharging the batteries, sleep scheduling method is always used during the monitoring process. Recently, many sleep schedules for event monitoring have been designed. However, most of the techniques focus on minimizing the energy consumption.

A small number of packets need to be transmitted during critical event monitoring. If any event is detected the alarm packet should be broadcast to the entire network. Therefore, broadcasting delay is an important problem for the application of the critical event monitoring. Here, unauthorized user enter into the network (or) misbehavior nodes in network that node is a critical node these event are detected by the any sensor node in WSN

In view of wake-up patterns, most sleep scheduling schemes can be categorized into two kinds:

(1) Synchronous wake-up pattern.

(2) Asynchronous wake-up pattern.

Sleep scheduling is a usual way for power management to save energy. Lots of works have studied it in WSNs, which can be classified into two main categories: 1) determined transmission pattern; 2) dynamic transmission pattern. In the first category, nodes periodically wake up and transmit at the determined time in each duty cycle, and time synchronization is always assumed. While, in the second category, nodes wake up and transmit at variation time in each duty cycle according to current traffic and time synchronization may not be needed. Among these works, most of them try to keep nodes sleeping as long as possible, while seldom study when nodes need to wake up to reduce the transmission delays. In other word, power saving is the main concern instead of transmission delay. To minimize the broadcasting delay, it is needed to reduce the waiting time during the broadcasting. The best scenario is the destination nodes wake up immediately when the source nodes obtain the broadcasting packets. Based on this idea, a level-by-level offset schedule is proposed. Hence, it is possible to achieve low transmission delay with node-by-node offset schedule in multi-hop WSNs. It is still a challenge for us to apply the level-by-level offset to alarm broadcasting in the critical event monitoring. Initial the order of nodes wakeup should be confirmed by using the traffic direction. If the traffic flow is in the opposite direction the delay in each hop will be as large as the length of the whole duty cycle.

Geographic routing is usually based on distance as its main parameter. Such routing schemes uses algorithm such as the geographic routing oriented sleep scheduling (GSS) & geographic-distance-based connected-*k* neighborhood (GCKN). But Geographic routing using distance as a parameter has many disadvantages too. The path selected using distance as a parameter results in delay and increase in retransmission cost. Thus the existing research was done to find out the shortest path from source to destination in Duty-Cycled Mobile sensor networks along with geographic routing as shown in fig 1. But there may be the case where we have the shortest path and the nodes are heavily loaded. Therefore all these works overlook one important fact that Load balancing also proves to be equally important factor. Thus there is no load consideration. It leads to increase in Delay and transmission cost, also decreases packet delivery ratio and throughput and hence the shortest path thus obtained is not optimal. These are some of the problems identified in this paper. Hence the need of research is to explore the various possibilities to determine the best optimal paths along with load balancing and all paths in Duty-Cycled Mobile sensor networks along with geographic routing and improving the network efficiency. The structure of this paper is as follows Section II surveys work related to our proposal. Section III describes the proposed system. Section IV describes implementation to determine the best optimal paths along with load balancing. Lastly section V presents the summary.

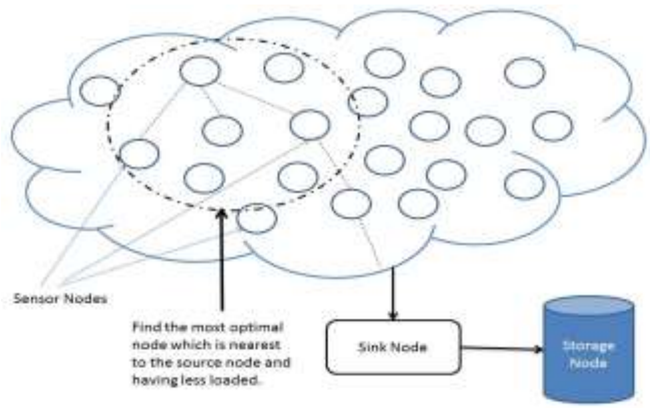

Fig 1

II. RELATED WORK

The author focused in [1] on the problem of fractional domatic partition problem and obtains a distributed approximation algorithm by applying linear programming approximation techniques. They suggested an algorithm based on Garg-K˙onemann (GK) scheme that requires solving an instance of the minimum weight dominating set (MWDS) problem and for the sleep scheduling problem. This algorithm is based on a mathematical framework that provides a guarantee on the solution quality.

In [2] the author described Use of WSN in industrial applications has rapidly increased but energy consumption still is an issue. The author proposes an Adaptive Staggered SLEEP Protocol (ASLEEP) for efficient power management in wireless sensor networks targeted to periodic data acquisition. This protocol dynamically adjusts the sleep schedules of nodes to match the network demands, without any prior knowledge of the network topology or traffic pattern. Under stationary conditions, the protocol effectively reduces the energy consumption of sensor nodes by dynamically adjusting their duty-cycle to current needs, increasing network lifetime. But Under time varying conditions the protocol is able to adapt the duty-cycle of single nodes to the new operating conditions while keeping a consistent sleep schedule among sensor nodes.

The authors in [3]focus on achieving better energy conservation for geographic routing algorithms in duty-cycled WSNs when there is a mobile sink. They simplify the problem as topology coverage one, and propose a multi-metric geographic algorithm (MMGR) which uses multi-metric candidates (MMCs) for geographic routing. They proved that MMGR achieve better energy conservations than McTPGF, retaining good performance of end-to-end delay and hop counts.

In surveillance system, while tracking the object, nodes operate in a duty cycling mode causing negatively impact on energy efficiency of node. Hence the author proposed a Probability-based Prediction and Sleep Scheduling protocol (PPSS) to improve energy efficiency of proactive wake up. The implemented system improves energy efficiency by 25-45 percent (simulation based) and 16.9 percent (implementation based) when comparing with existing algorithm.[5]

In[6] author proposed a cross-layer organizational approach based on sleep scheduling, called Sense Sleep Trees (SS-Trees), aims to harmonize the various engineering issues and provides a method to increase the monitoring coverage and the operational lifetime of mesh-based WSNs engaged in wide-area surveillance applications. A SS- Trees is suggested to minimize the energy usage while providing sufficient monitoring capabilities. Author proposed an ILP formulation based on the network flow model is to tackle the core problem of determining how the sensor nodes can assigned to a predetermined number of SS-Trees on a given WSN topology.

III. PROPOSED SYSTEM

To find the optimal path from source to destination node in a Duty Cycled Mobile sensor Network with Geographic routing

Following criteria will be used for optimally selecting a neighboring node by source node for routing the packet.

A: Distance criteria

Using GCKNF and GCKNA sleep scheduling the neighboring nodes will be arranged in ascending order of distance from the source node i.e. the node nearest from the source will be first, the greater distance will be next and so on.

For ex. If there are 5 neighboring nodes with distance from source node as follows: N1(5), N2(4), N3(6), N4(8), N5(3).

So the set will contain the above nodes arranged in following sequence:

set A={N5,N2,N1,N3,N4}

B: Delay Calculation

The neighboring nodes will be arranged in ascending order of calculated delay i.e. the nodes having least delay will be the first and so on. This will give set B.

C: Load Balancing criteria

The neighboring nodes will be arranged in ascending order of load encountered on the node i.e. the node with less load will be first, higher load will be second and so on.

Load balancing will be done on PDR i.e. packet delivery ratio.

So the nodes with higher PDR will be less loaded and hence the node with higher PDR will be the first node, node with less PDR will be second and so on. So if the PDR for above 5 nodes is N1(5), N2(4), N3(6), N4(8), N5(3) then the set arranged according to load balancing will be as follows:

Set C={N4,N3,N1,N2,N5}

D: Node Selection Criteria

1) The number of nodes in set B will be divided by 2 which will give 2 subsets B1 and B2. B1 will have first half nodes and B2 will have second half of nodes
2) For each node in set A the position of the selected node will be checked in set B1. If it is in subset B1 then the node will be put in a Final set, if not then the node will be rejected.
3) The final set will contain the optimal set of nodes which are not much far from the selected node and which are moderate delay.
4) Next the final set of nodes will be compared with number of nodes in C divided by 2 to get the final node for the path.
5) The steps from 1 to 4 will be repeated with the node selected in step 4 to select the next hop node.

Working System:

Calculation of Distance:-

Initially we find the distance between the neighboring nodes. The distance between the two nodes and all the neighboring nodes is calculated by using two geographic-distance-based connected-k neighborhood (GCKN) sleep scheduling algorithms. First is geographic-distance-base connected-k neighborhood for first path (GCKNF)sleep scheduling algorithm, which is designed to explore shorter first transmission paths for geographic routing in duty cycled mobile WSNs. While the second is geographic-distance-based connected-k neighborhood for all paths (GCKNA) sleep scheduling algorithm aims at shortening all routing paths for multipath transmissions in duty-cycled mobile WSNs.

These GCKN algorithms incorporate the connected-k neighborhood requirement and geographic routing requirement to change the asleep or awake state of sensor nodes. Thus we get set of nodes sorted according to distance.

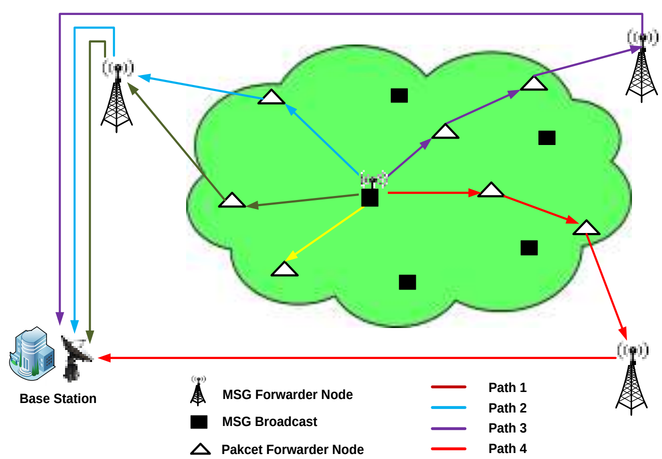

Fig 2

Describe the overall proposed process of system. Here it shows three main entities.

1. MSG forwarder node: this will transfer the message from wireless sensor node to base station
2. MSG broadcast Node: this will generate the actual message and work as a sink node
3. Packet forwarder node: this will goes in sleep or wake state and work as a packet forwarder node

IV. DESIGN AND IMPLEMENTATION

Outcomes

The research has been carried out with three different total numbers of nodes. They are 25, 45 and 65. However, here only outcomes of total numbers of nodes that are 45 nodes have been included. The following outcomes are obtained during each phase:

Topology Formation and Setup Phase

The topology formations among nodes for the nodes which are 1-hop distance away are displayed in Fig.. In this phase, hello packets are sending to all its neighbor nodes those are 1-hop distance away from sender node. The black coloured node indicates that the node is in state to start topology formation for 1-hop nodes. The omni-directional antennas are sending signals to neighbor nodes. One of the nodes becomes sender node and starts sending hello packets to nodes that are 1-hop distance away. The neighbor nodes become receiver and starts receiving hello packets. The pink coloured node indicates that the node has completed topology formation for 1-hop neighbor.

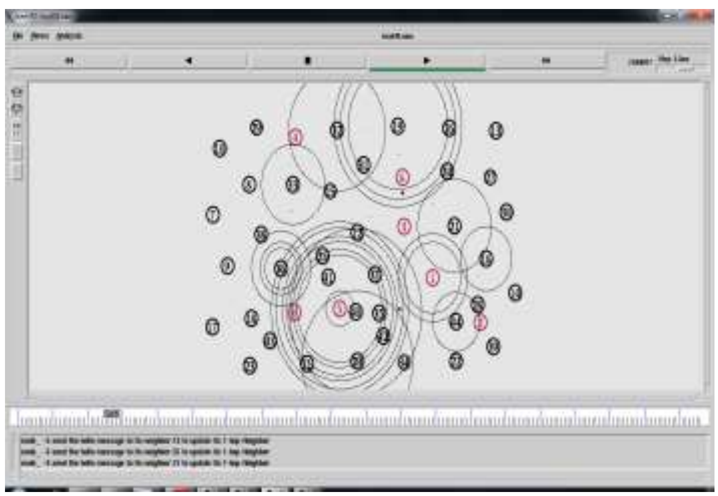

Fig. Topology formation for 1-hop neighbors

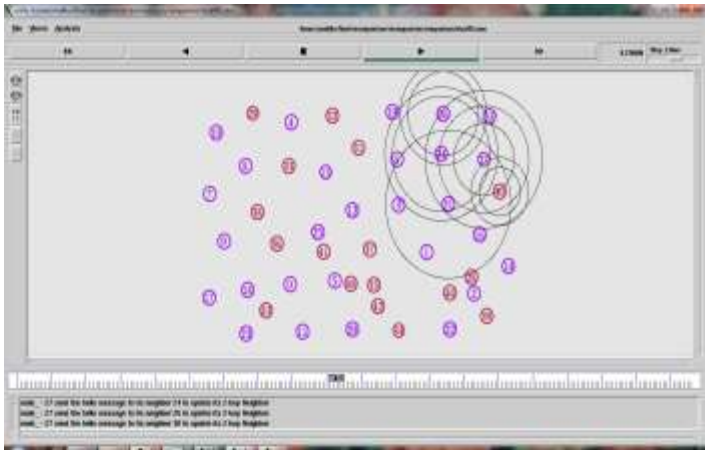

Fig. Topology formation for 2-hop neighbors

The topology formation for 2-hop neighbor is illustrated in Fig. The pink Coloured nodes indicate the node is in the state to start sending hello packets to its 2-hop neighbors. Node number 30 is performing topology formation for 2-hop neighbors. This node first send signal to nodes that are 2-hop distance away. After confirming the range the node number 30 acts as source and starts sending hello packets. Nodes that are 2-hop distance away acts as receivers. The violet coloured nodes indicate that node had already completed 2-hop topology formation.

V. SUMMARY

As the proper sleep scheduling provides benefits of energy saving and transfer efficiency hence following points are expected from the proposed system. Multiple path and broadcast methodology will give 100% data transfer accuracy,

Every path and every node will switch to sleep and wake state one after another way and Reduce data flooding by decreasing the data receiving density at receiving end. The proposed system will calculate the best optimal path from source node to destination by taking into consideration the load on each node and delay incurred by each node.

REFERENCES

1. Schumacher and Harri Haanp, "Distributed Sleep Scheduling in Wireless Sensor Networks via Fractional Domatic Partitioning", *Springer-Verlag Berlin Heidelberg 2009*.
2. Giuseppe Anastasi, Marco Conti, Mario Di Francesco, "Extending the Lifetime of Wireless Sensor Networks through Adaptive Sleep", *IEEE Transactions on Industrustrial informatics, Vol 12, 2008.*

3. Can Ma1, Lei Wang1, Jiaqi Xu1, Zhenquan Qin1, Ming Zhu1, Lei Shu2 “A Geographic Routing Algorithm in Duty-Cycled Sensor Networks with Mobile Sinks”.2011 2011 IEEE Seventh International Conference on Mobile Ad-hoc and Sensor Networks

4. Bo Jiang, Binoy Ravindran, and Hyeonjoong Cho, “Probability-Based Prediction and Sleep Scheduling for Energy-Efficient Target Tracking in Sensor Networks”, *IEEE Transactions On Mobile Computing, Vol. 12, No. 4, April 2013.*

5. Rick W. Ha, Pin-Han Ho, X. Sherman Shen, Junshan Zhang, “Sleep scheduling for wireless sensor networks via network flow model”, *Computer Communications 29 (2006) 2469–2481, Elsevier March 2006.*

6. Chunsheng Zhu, Laurence T. Yang, Lei Shu†, Joel J. P. C. Rodrigues‡, Takahiro Hara “A Geographic Routing Oriented Sleep Scheduling Algorithm in Duty-Cycled Sensor Networks “ in IEEE ICC 2012 - Wireless Networks Symposium.

7. Chunsheng Zhu, Laurence T. Yang, Lei Shu, Victor C. M. Leung, Joel J. P. C. Rodrigues, and Lei Wang, *“*Sleep Scheduling for Geographic Routing in Duty-Cycled Mobile Sensor Networks” in IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 61, NO. 11, NOVEMBER 2014

8. Pedro Pinto, António Pinto, Manuel Ricardo in “End-to-End Delay Estimation using RPL Metrics in WSN” 978-1-4799-0543-0/13/$31.00 ©2013 IEEE.

9. BiJun Li, MinJung Baek, SeUng Hyeon, and Ki-Il Kim” Load Balancing Parameters for Geographic Routing Protocol in Wireless Sensor Networks” in 978-1-4244- 7618-3 /10/$26.00 ©2010 IEEE

10. Cheng Guo, Jinglong Zhou, Przemysław Pawełczak and Ramin Hekmat “Improving Packet Delivery Ratio Estimation for Indoor Ad Hoc and Wireless Sensor Networks” in 978-1-4244-2309-5/09/$25.00 ©2009 IEEE