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ENERGY COMPETENCY FOR GEOGRAPHICAL ROUTING SCHEME USING DUTY CYCLED WIRELESS SENSOR NETWORK

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Abstract- *Wireless sensor networks have wide range of applications. The major constraint in such application lies in the limitation of energy resource. The sensors are often equipped with tiny and irreplaceable batteries. It arise the need of energy efficient routing algorithms to prolong the network lifetime. This project mainly focuses on sleep scheduling for geographic routing in duty-cycled WSNs with mobile sensors by using geographic-distance-based connected-k neighborhood (GCKN) sleep scheduling algorithms. It ensures that coverage rotates such every purpose within the surroundings is perceived at intervals some default interval of your time, referred to as the detection delay. The structure is optimized for rare event detection and permits favorable compromises to be achieved between event detection delays and eventual coverage for every purpose. The cluster activation protocol makes sure that the foremost potential clusters activated to perform target pursuit, reducing consumed energy throughout the hand-off operation. The experimental results show that when there are mobile sensors, geographic routing can achieve much shorter average lengths for all paths using GCKN sleep scheduling compared with those in WSNs employing CKN and GSS sleep scheduling.*

Index Terms- GCKA, GCKF, GCKN, Mobile Sensor

I. INTRODUCTION

Wireless Sensor Network (WSN) is a collection of spatially deployed wireless sensors by which to monitor various changes of environmental conditions (e.g., forest fire, air pollutant concentration, and object moving) in a collaborative manner without relying on any underlying infrastructure support. Recently, a number of research efforts have been made to develop sensor hardware and network architectures in order to effectively deploy WSNs for a variety of applications. Due to a wide diversity of WSN application requirements, however, a general-purpose WSN design cannot fulfill the needs of all applications. Many network parameters such as sensing range, transmission range, and node density have to be carefully considered at the network design stage, according to specific applications. To achieve this, it is critical to capture the impacts of network parameters on network performance with respect to application specifications.

Since a distributed network has multiple nodes and services many messages, and each node is a shared resource, many decisions must be made. There may be multiple paths from the source to the destination.

The main performance measures affected by the routing scheme are throughput (quantity of service) and average packet delay (quality of service). Routing schemes should also avoid both deadlock and livelock. Routing methods can be fixed (i.e. Pre-planned, adaptive, centralized, distributed, broadcast, etc. Perhaps the simplest routing scheme is the token ring. Here, a simple topology and a straightforward fixed protocol result in very good reliability and precomputable QoS.

II. PROBLEM STATEMENT

In a large-scale mobile wireless sensor network, hundreds or thousands of tiny sensor nodes are randomly deployed into a monitoring field to gather data. The difficulties of computation sleeping nodes and communication within network increases with the number of active sensor nodes by tracking the target using mobile sensors. The amount of energy used in the network is proportional to the number of active sensor nodes. Active nodes must be pro-activated to control from sleeping. It is best for sensor nodes to be arranged into collaborative m groups. This group helps to identify sleeping nodes and active nodes within a network.

Group collaboration should be limited to a tracking area around the target so that the communication and computation will be independent of the size of the network. Multiple nodes surrounding the target may collaborate and gather information. The tracking accuracy and performance is limited to the information in those sensors.

In a large-scale sensor network, it is important to locate the target node with high accuracy while consuming the least amount of energy of resources.

PPSS has limitations as well. First, it does not use optimization methods, i.e., PPSS imposes no performance constraints when reducing the energy consumption. Without performance constraints, it is difficult to configure the protocol toward the best energy performance tradeoff for a specific network environment.

Second, the prediction method of PPSS cannot cover special cases such as the target movement with abrupt direction changes. This is the expense that PPSS pays for the energy efficiency enhancement. Given these limitations, the potential our work includes optimization-based sleep scheduling and target prediction.

Our objective is to propose a simple routing metric that is composed of the energy expenditure and battery power of a node. The limitation of energy consumption will help to utilize the resources efficiently. Therefore, the cluster activation phase has a great importance not only in minimizing energy consumption but also improve the optimized tracking accuracy within a wireless network.

III. EXISITING SYSTEM

In spite of the diverse applications, WSNs face a number of unique technical challenges due to their inherent energy and bandwidth limitations, ad hoc deployment, and unattended operation, etc.,. Unfortunately, very little previous works on distributed systems can be applied to WSNs, since the underlying assumptions have changed dramatically. Therefore, innovative energy-aware, scalable, and robust algorithms for distributed signal processing in WSNs are highly required. A problem that is closely related is the localized topology control, which maintains energy-efficient network connectivity by controlling the transmission power at each node, or selecting a small subset of the local links of a node.

Since nodes often run on batteries that are generally difficult to be recharged once deployed, energy efficiency is a critical feature of WSNs for the purpose of extending the network lifetime. Target tracking in WSNs has been studied extensively. Due to the limited sensing capability and limited resources for communications and computation, collaborative resource management is required to trade-off between the tracking accuracy. Therefore, energy-efficient target tracking should improve the tradeoff between energy efficiency and tracking performance e.g., by improving energy efficiency at the expense of a relatively small loss on tracking performance. For target tracking applications, idle listening is a major source of energy waste.

Disadvantages-

•However, if energy efficiency is enhanced, the quality of service (QoS) of target tracking is highly likely to be negatively influenced. For example, forcing nodes to sleep may result in missing the passing target and lowering the tracking coverage.

•Sleep scheduling inevitably increases the probability of losing track of the object when the sensor nodes that should be active are asleep.

IV. PROPOSED SYSTEM

Our proposed work, present a probability-based target prediction and optimized sleep scheduling protocol (PPOSS) to improve the efficiency of proactive wake up and enhance the energy efficiency with limited loss on the tracking performance. With a target prediction scheme based on both kinematics rules and theory of probability, PPSS not only predicts a target's next location, but also describes the probabilities with which it moves along all the directions.

On receiving an alarm message, each candidate may individually make the decision on whether or not to be an awakened node, and if yes, when and how long to wake up.

We utilize two approaches to reduce the energy consumption during this proactive wake-up process:

•Reduce the number of awakened nodes to utilize the energy resources over the network.

•Schedule their sleep pattern to shorten the active time.

It makes the sleeping nodes to wake mode in order to find the shortest path to send packets of information. This helps to reduce end to end latency problem within the wireless networks.

First, the number of awakened nodes can be reduced significantly, because:

1. Those nodes that the target may have already passed during the sleep delay do not need to be awakened.

2. Nodes that lie on a direction that the target has a low probability of passing by could be chosen to be awakened with a low probability. For this purpose, we introduce a concept of awake region and a mechanism for computing the scope of an awake region.

Second, the active time of chosen awakened nodes can be curtailed as much as possible, because: They could wake up and keep active only when the target is expected to traverse their sensing area. For this purpose, we present a sleep scheduling protocol, which schedules the sleep patterns of awakened nodes individually according to their distance and direction away from the current motion state of the target.

V. ARCHITECTURAL DIAGRAM

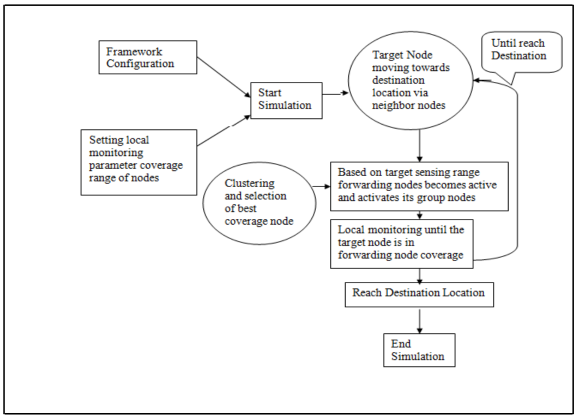


FIG 1: ARCHITECTURAL DIAGRAM OF PROPOSED SYSTEM.

VI. GCKN ALGORITHM

The communication system of the node can be switched off and it moves into the sleep state as it does not participate in any data exchange. The sensor that was not involved in transmission was in idle state which consumes less power than transmission and reception state. The sensors that need to transmit data in awaken state and choose its neighbors to forward data. After it chooses neighbors it sends flag to the neighbor node/destination to be awaken. When the node is in sleep state only the radio transceiver is in off condition other than all components are in on condition.

Sleep scheduling and mobility technique algorithm: The sleep scheduling problem in duty cycled WSNs with mobile nodes (referred to as mobile WSNs in the following) employing geographic routing. The two geographic distance based connected-k neighborhood (GCKN) sleep scheduling algorithms. The first one is geographic- distance-based connected-k neighborhood for first path1 (GCKNF) sleep scheduling algorithm, aiming at geographic routing utilizing only first transmission path in duty-cycled mobile WSNs. The second one is geographic- distance-based connected-neighborhood for all paths2 (GCKNA) sleep scheduling algorithm, for geographic routing concerning all paths explored in duty-cycled mobile WSNs. The main contributions of GCKN algorithm are summarized as follows.

1) This algorithm is a new work proposing and analyzing sleep scheduling algorithms for geographic routing in duty- cycled mobile sensor networks, which takes full advantages of both duty cycling and sensor mobility.

2) Specifically, these two GCKN algorithms effectively extend existing geographic routing algorithms designed for static WSNs into duty- cycled mobile WSNs by applying sleep scheduling. The GCKNF sleep scheduling algorithm is designed for shortest first transmission paths for geographic routing in duty cycled mobile WSNs. The GCKN sleep scheduling algorithm aims at shortening all routing paths for multipath transmissions in duty- cycled mobile WSNs. These GCKN algorithms integrate the connected-k neighborhood requirement and geographic routing requirement to change the asleep or awake state of the sensor nodes.

VII. PSEUDO CODE

First: Run the following at each node u.

1) Send probe packet pu to neighbors and receive the acknowledgement packet.

2) calculate whether u's current neighbors CNu ≥ min (k, du).

3) Maintain its transmission radius if the above condition holds or its current transmission radius is the

Maximum else increase its transmission radius until CNu ≥ min (k, du).

Second: Run the following at each node u.

1) Get its geographic location gu and sink location gs.

2) Broadcast gu and receive the geographic locations of its all neighbors Au. Let Gu be the set of these geographic locations.

3) Unicast a flag to w, w ∈ Au and gw is the closest to sink in Gu.

Third: Run the following at each node u.

1) Select a random rank ranku.

2) Broadcast ranku and receive the ranks of its currently awake neighbors Nu. Let Ru be the set of these ranks.

3) Broadcast Ru and receive Rv from each v ∈ Nu.

4) If |Nu| < k or |Nv | < k for any v ∈ Nu, remain awake. Return.

5) Calculate Cu = {v|v ∈ Nu and rankv < ranku}.

6) Go to sleep

if the following three conditions hold else remain awake.

• Any two nodes in Cu are connected either directly themselves or indirectly through nodes within u's two-hop neighborhood that have rank less than ranku.

• Any node in Nu has at least k neighbors from Cu.
• It does not receive a flag.
7) Return.

VIII. IMPLEMENTATION

a) SENSOR NETWORK FORMATION

It contribute to a more systematic understanding and treatment of sensor deployment issues. For this purpose, we studied the existing literature on deployment experience and present a classification of common problems encountered during deployment of sensor networks.

b) ROUTING PROTOCOL DESIGN

A routing protocol is a protocol that specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network, the choice of the route being done by routing algorithms. Each router has a prior knowledge only of networks attached to it directly. A routing protocol shares this information first among immediate neighbors, and then throughout the network. This way, routers gain knowledge of the topology of the network.

Design a Routing protocol named as PPOSS (Probability-based Prediction and Optimization- based Sleep Scheduling protocol), which is going to implement in OSI layer that need to get and deliver the messages from other layers for that make some more changes in supported layers. The routing protocol is implemented in the layered architecture of the GloMoSim simulator.

c) SLEEP WAKE SCHEDULING

Measurements have shown that the energy that a sensor node spends while idly listening amounts to 50%-100% of the energy required for receiving. Furthermore, typically, a sensor node would spend a substantial fraction of the time in the idle state. Therefore, idle listening has been recognized as one of major sources of energy waste in sensor networks and sleep scheduling has been widely studied. The mainstream of research on sleep scheduling can be divided into two approaches. One approach, the “periodical packet-arrival based approach”, assumes periodical packet arrival, thus proposing a periodic active/sleep (i.e., ON/OFF) schedule.

The sensors that need to transmit datain awaken state and choose its neighbors to forward data. After it chooses neighbors it sends flag to the neighbor node/destination to be awaken. When the node is in sleep state only the radio transceiver is in off condition other than all components are in on condition

The second approach is “coverage-based approach”, which assumes large density of sensor nodes, thus maintaining the connectivity of the network by subsets of nodes which are ON all the time, while letting the other nodes sleep. There are also various strategies for adaptation of the sleeping schedule that is ending the ON period according to different criteria, such as the overheard messages, the network topology, the residual energy of the nodes, the most recently updated neighbor sleeping schedule, the database of neighbor nodes’ sleeping schedule, the number of packets queued in the MAC layer, and the waiting time of packets and the length of waiting queue in the previous node.

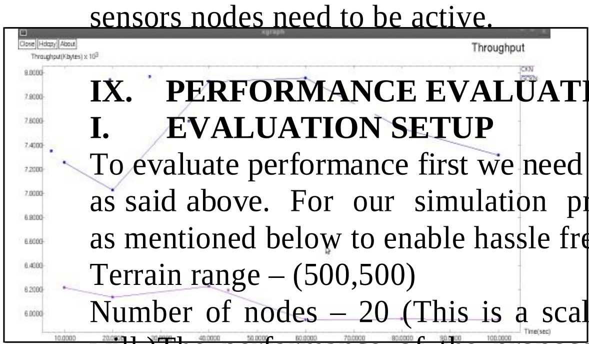
d) CLUSTERING SCHEME

A cluster-based scheme is proposed, where sensors are statically divided into clusters, and each cluster consists of a single Cluster Head (CH) and a bunch of slave sensors. At every sampling instant, only one cluster of sensors is triggered to track the target. When a target enters the wireless sensor network, the CH that detects the target becomes active while other nodes are in sleep mode. Then the active CH selects three sensor nodes of its members for tracking in which one node is selected as Leader node. The selected nodes sense the target and current target location is calculated.

e) TARGET TRACKING APPROACH

It quantifies the benefits of our approach in terms of energy consumed and accuracy of tracking for different mobility patterns. The key issues in tracking a mobile target are accuracy of tracking and energy expenditure. The accuracy of tracking is strongly influenced by the number of active sensor nodes.

The more sensor nodes that are active, the higher will be the accuracy in tracking. Too few will result in inaccurate tracking. On the other hand, energy expenditure is proportional to the number of active sensor nodes; the larger the size of the active tracking region, the higher the energy consumption. To accurately track the target and minimize energy, a minimum set of sensors nodes need to be active.



IX. PERFORMANCE EVALUATION

I. EVALUATION SETUP

To evaluate performance first we need to specify the necessary input parameters in the Config.in file as said above. For our simulation procedure, we have been specific about certain parameters as mentioned below to enable hassle free simulation

Terrain range – (500,500)

Number of nodes – 20 (This is a scalable simulator. Hence number of nodes can be increased at will.)The performance of the proposed algorithm is evaluated via glomosim simulator. Performance metrics are utilized in the simulations for performance comparison:

•Packet arrival rate. The ratio of the number of received data packets to the number of total data packets sent by the source.

•Average end-to-end delay. The average time elapsed for delivering a data packet within a successful transmission.

•Communication overhead. The average number of transmitted control bytes per second, including both the data packet header and the control packets.

•Energy consumption. The energy consumption for the entire network, including transmission energy consumption for both the data and control packets.

II. EVALUATION RESULTS

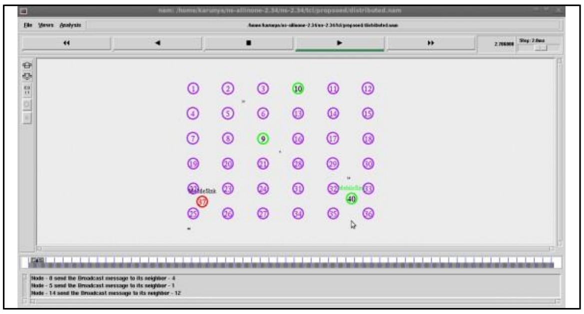


FIG 2: Message Broadcasting (Multipath)

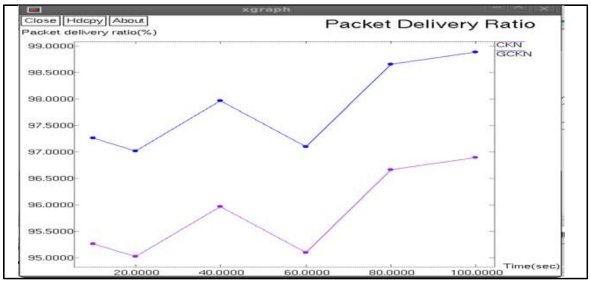


FIG 3. Packet Delivery Ratio (Multipath)

X. CONCLUSION

In this paper, a system is developed in such a way that target tracking in WSN with mobile sensor is done in efficient way using an energy efficient prediction based sleep scheduling algorithm based on GCKN algorithm. In the duty-cycled sensor network, proactive wake up and non-proactive with table driven along with sleep scheduling can create a local active environment to provide guarantee for the tracking performance of the wireless networks. Mobile sensors are used to track the sleeping nodes and message passing on network. By effectively limiting the scope of this local active environment by reducing low value- added nodes that have a low probability of detecting the target, PPSS improves the energy efficiency with an acceptable loss on the tracking performance. Given some limitations in tracking accuracy, the potential future work includes optimization-based sleep scheduling and target prediction for abrupt direction changes.

XI. REFERENCES

1. I.F. Akyildiz, W. Su, Y. Sankarasubramaniam, and E. Cayirci, “Wireless Sensor Networks: A Survey,” Computer Networks, vol. 38, no. 4, pp. 393-422,
2002.

2. Q. Cao, T. Yan, J. Stankovic, and T. Abdelzaher, “Analysis of Target Detection Performance for Wireless Sensor Networks,” Proc. Int’l Conf. Distributed Computing in Sensor Systems (DCOSS), pp. 276-292, 2005.

3. G. Wittenburg, N. Dziengel, C. Wartenburger, and J. Schiller, “A System for Distributed Event Detection in Wireless Sensor Networks,” Proc. Ninth ACM/IEEE Int’l Conf. Information Processing in Sensor Networks (IPSN ’10), pp. 94-104, 2010.

4. T. He, P. Vicaire, T. Yan, L. Luo, L. Gee, G. Zhou, R. Stoleru, Q. Cao, J.A. Stankovic, and T. Abdelzaher, “Achieving Real-Time Target Tracking Using Wireless Sensor Networks,” Proc. 12th IEEE Real-Time and Embedded Technology and Applications Symp. (RTAS ’06), pp. 37-48, 2006.

5. Q. Cao, T. Abdelzaher, T. He, and J. Stankovic, “Towards Optimal Sleep Scheduling in Sensor Networks for Rare Event Detection,” Proc. Fourth Int’l Symp. Information Processing in Sensor Networks, p. 4, 2005.

6. C. Gui and P. Mohapatra, “Power Conservation and Quality of Surveillance in Target Tracking Sensor Networks,” Proc. 10th Ann. Int’l Conf. Mobile Computing and Networking, pp. 129-143,
2004.

7. G. Lu, N. Sadagopan, B. Krishnamachari, and A. Goel, “Delay Efficient Sleep Scheduling in Wireless Sensor Networks,” Proc. IEEE INFOCOM, vol. 4, pp.
2470-2481, Mar. 2005.

8. Y. Gu and T. He, “Data Forwarding in Extremely Low Duty-Cycle Sensor Networks with Unreliable Communication Links,” Proc. Fifth Int’l Conf. Embedded Networked Sensor Systems (SenSys
’07), pp. 321-334,2007.

9. Y. Wu, S. Fahmy, and N. Shroff, “Energy Efficient Sleep/Wake Scheduling for Multi-Hop Sensor Networks: Non-Convexity and Approximation Algorithm,” Proc. IEEE INFOCOM, pp. 1568-1576, May 2007.

10. X. Wang, J.-J. Ma, S. Wang, and D.-W. Bi, “Cluster-Based Dynamic Energy Management for Collaborative Target Tracking in Wireless Sensor Networks,” Sensors, vol. 7, pp. 1193- 1215, 2007.

11. J. Fuemmeler and V. Veeravalli, “Smart Sleeping Policies for Energy Efficient Tracking in Sensor Networks,” IEEE Trans. Signal Processing, vol. 56, no. 5, pp. 2091-2101, May 2008.

12. J. Jeong, T. Hwang, T. He, and D. Du, "MCTA: Target Tracking Algorithm Based on Minimal Contour in Wireless Sensor Networks," Proc. IEEE INFOCOM, pp. 2371-2375, 2007.
13. X. Wang, J.-J. Ma, S. Wang, and D.-W. Bi, "Prediction-Based Dynamic Energy Management in Wireless Sensor Networks," Sensors, vol. 7, no. 3, pp. 251-266, 2007.
14. Y. Xu, J. Winter, and W.-C. Lee, "Prediction- Based Strategies for Energy Saving in Object Tracking Sensor Networks," Proc. IEEE Int'l Conf. Mobile Data Management, pp. 346-357, 2004.