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Enhancement for Proactive Data Reporting of Wireless Sensor Network using Wake Up Scheduling Algorithm

Santoshi P. Biradar, **Poonam D. Lambhate**

Abstract: ***In Wireless Sensor Network (WSNs), gather the data by using mobile sinks has become popular. Reduce the number of messages which is used for sink location broadcasting, efficient energy data forwarding, become accustomed to unknown earthly changes are achieved by a protocol which is projected by a SinkTrail. The forecast of mobile sinks' location are done by using logical coordinate system. When sensor nodes don't have any data to send, at that time they switch to sleep mode to save the energy and to increase the network lifetime. And due to this reason there is a chance of the involvement of nodes that are in sleeping state between the path sources to the mobile sink which is selected by the SinkTrail protocol. Before become the fully functional and process the information, these sleeping nodes can drop the some information. Due to this reason, it is vital to wake-up the sleeping nodes on the path earlier than the sender can start transferring of sensed data. In this paper, on-demand wake-up scheduling algorithm is projected which is used to activates sleeping node on the path before data delivery. Here, in this work the multi-hop communication in WSN also considers. By incorporating wake-up scheduling algorithm to perk up the dependability and improve the performance of on-demand data forwarding extends the SinkTrail solution in our work. This projected algorithm improves the quality of service of the network by dishonesty of data or reducing the loss due to sleeping nodes. The efficiency and the effectiveness projected solution are proved by the evaluation results.***

Index Terms: ***Wireless sensor network, wake-up scheduling, communication system routing, data reporting of WSN, routing.***

I. INTRODUCTION

In wireless sensor network (WSN) applications, incessant monitoring is an important form. A large number of sensor nodes are employed by a continuous monitoring for data gathering and continuous sensing. In wireless sensor network, every sensor node every so often senses and creates a specific type of data. Furthermore, node reports that data to one or several base station(s). In wireless sensor network (WSNs) consist of a variety of applications that's why they have grow to be admired in various fields like forest fire detection [1], habitat monitoring [2], environmental science, home health care, military surveillance. A wireless sensor network (WSNs) are generally used for the low cost and long term monitoring applications. While designing the sensor network protocols, the minimization of energy consumption is a key challenge concerned in wireless sensor network.

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* Correspondence Author
Santoshi P. Biradar*, ME (Student) JSCOE, Hadapsar, Pune, India.
Poonam D. Lambhate, Asso. Prof., JSCOE, Hadapsar, Pune, India.

Existing research efforts demonstrate that permitting sink mobility is more energy efficient approach for data gathering [3] instead of instituting extended multi-hop routes to the sink to report data. Wireless communication capability used as a mobile sinks which is equipped to achieve mobility, animals or vehicles. To reduce energy consumption and data transmission paths, the mobile sinks trail from one location to another location to collect data from sensor nodes. Even idle listening by sensor nodes consumes a significant amount of energy decreases the lifetime of the node are proved by various studies done on power consumption in WSN. Consequently, switch the sensor node to sleep mode throughout idle times and wake it up at periodical intervals to ensure presence of any data is an effectual approach to conserve energy in WSN.

A. *Existing Techniques Limitation*

SinkTrail, a greedy data forwarding protocol which is self adaptive to various application scenarios projected by a Xinxin Liu et al. [4]. Mobile sinks move incessantly in the field in comparatively low speed, and gather data on the fly in SinkTrail. However, in wireless sensor network the authors fail to consider sleep/wake approach used to conserve energy.

B. *Our Observations*

The sleep/wake scheduling provides perfect synchronization is assumed by existing research efforts. The impact of synchronization error is non-negligible are proved by the authors [5]. We experiential that even though existing systems try achieving exact synchronization between wake-up of sensor nodes for transmission/reception of data, there still lives arbitrary synchronization error due to the non deterministic factors in the system.

C. *Our Solution*

In wireless sensor network (WSN), on-demand wake up scheduling for proactive data reporting are projected in this paper. It is relies on the SinkTrail protocol to retrieve the shortest path to the mobile sink. The projected approach sends a wake-up message to all nodes in the path rather than directly starting data transmission, once the path is obtained. This is useful for the nodes which are in sleeping mode to switch to an active working state. As a result, it perks up the dependability of the system by reducing the synchronization errors and data loss. The source node starts data transmission to the mobile sink upon the acknowledgement from nodes in the route. The efficiency and effectiveness of the projected solution are proved evaluation results.

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D. Our Contributions

In wireless sensor network, for proactive data reporting on-demand wake-up scheduling projected in this paper. Our contributions in this paper are

1. To extend Sink Trail protocol by projecting a wake-up scheduling technique.
2. This work also discovers the impacts of several intend strictures of the projected solution.
3. Projected solution and conducted extensive simulation based experiments implemented here. The efficiency and effectiveness of the projected solution are proved evaluation results.

In this paper we discuss about the related work in section II, proposed method in section III where we design our solution, mathematical model, algorithms. In section IV we proved the simulation result with graph and at last conclusion in section V.

II. RELATED WORK

Due to the arbitrary movement of the nodes and multi-hop routing, a lot of control signal overhead is introduce for route discovery in wireless sensor networks (WSN). It is intolerable in energy-constrained wireless sensor networks. Constantly changing topology and energy constraints are served by the sensor nodes. Sensor nodes frequently switch themselves into a sleep state and occasionally wake-up to check, if there is data for them to send to the sink, to perk up the network lifetime in WSN. In order to reduce the energy consumption and design sleep/wake-up scheduling algorithms for a wireless sensor network (WSN) wide research efforts have been taken.

E. Sleep/Wake Scheduling for Sensor Networks

MAC based protocols can be classified as contention based or TDMA in wireless sensor networks. Waste of energy occurs due to collisions, idle listening and overhearing in contention based MACs. Therefore to avoid eavesdropping and save energy of nodes in WSN, research efforts [6], [7] projected mechanisms.

F. Clustering

A hierarchical clustering techniques developed by a class of research efforts. To manage large wireless sensor networks, clustering is an energy efficient and scalable method. Nodes which are close to each other and within a geographical region are grouped together to form a cluster. Base station selects one node from each cluster as a cluster head that is CH which is organize with the nodes within the cluster. As well CH is responsible for communication between the cluster and the BS or other cluster heads. This grouping process can be recursively applied on other clusters, to build a cluster hierarchy.

G. Mobile Agent Scheduling

Mobile Element Scheduling (MES) algorithms [8], [9], [10], [11], [12] focus by the class research efforts. Mobile sink mobility controlled and prediction of the moving path of the mobile sink is considered by this algorithm.

- Summary: The two wrong assumptions are making by the most existing sleep/wake scheduling schemes. First, nearly perfect synchronization can be provided by the underlying synchronization protocol. Second is clock disagreement is negligible. While designing a solution for wireless sensor network, it is critical to integrate sleep/wake scheduling. To improve the performance and perk up the dependability of on-demand data forwarding by incorporating wake-up scheduling algorithm expanded the sink solution in this paper.

III. PROPOSED METHOD

H. Mathematical Model

In this paper, the problem addressed formulated . Here, for any given network of N nodes like data collected D in the sink is maximum. Thus if di is data sent by node ni then the total data D collected by the sink in time t is given as:

$$D = \sum_{t=1}^{k} \sum_{i=0}^{N} d_{it}$$

Where,

N = total number of nodes.

n_i = the i^{th} sensor node, where I = 1,2,3,…..n

S = the mobile sink

msg.seqN = the message sequence number

mag.hopC = the message hop count

E_i = the initial energy of node n_i

I. Proposed System Algorithm

The proposed system algorithm is given below,

Step 1: Using the SinkTrail protocol, perform the logical space coordinate space construction.

Step 2: Using the Sink Trail protocol, nodes in the network start sending data to the mobile sink.

Step 3: Let K be the time for which we wish to run the protocol.

Step 4: Let n_{1s}, n_{2s}, n_{3s} …n_{ms} be the total number of m nodes, who choose sleep mode as they don't have to send data.

Step 5: Let n_{src} be the source node that needs to send the data sink. It gets the path to the sink node S using the SinkTrail protocol.

Step 6: The list of sleeping nodes which are in its path to sink is created by the n_{src}.

Step 7: For these sleeping nodes, wake-up request generated by the n_{src}.

Step 8: n_{src} starts data transfer, after a response from all sleeping nodes. Or else, it initiates a request to the sink to establish an alternative path.

IV. SIMULATION RESULT

It performed on several arbitrary networks created by distributing nodes in random order, to evaluate the projected algorithm. To evaluate situation-specific performance in networks is the aim of this test. Custom simulator software was developed in java to run simulation and perform assessment tests. The overall system performance is exaggerated by the number of mobile sinks. Several logical coordinate spaces are building concurrently and data packets are forwarded to the destination orientation via the shortest path in any coordinate space. Heavier weights for trail message broadcasting and routing information maintenance imposed by increasing the number of mobile sinks.

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Here we shows the graph, in figure 1 illustrate the energy utilization of each node with wake-up algorithm. Figure 2 illustrate the energy utilization of each node without wake-up algorithm. By comparing two graphs we see that without wake-up algorithm use high energy. That means using wake-up algorithm we save the energy utilization and increase the lifetime of network. In figure 3 network size verses energy utilization where we see the wake-up algorithm use less energy as compared to the without wakeup. Hence this evaluation shows that our projected solution save the energy and increase the lifetime of network.

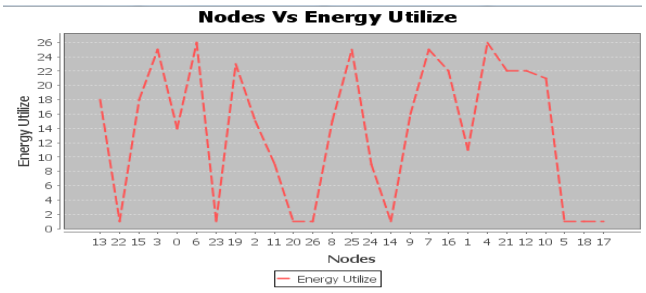

Fig. 1 With Wake-Up Algorithm

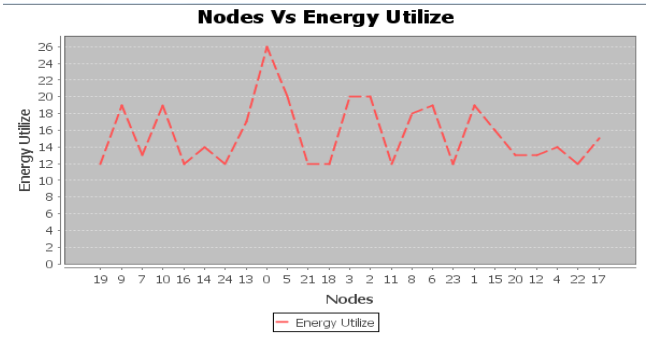

Fig. 2 Without Wake-Up

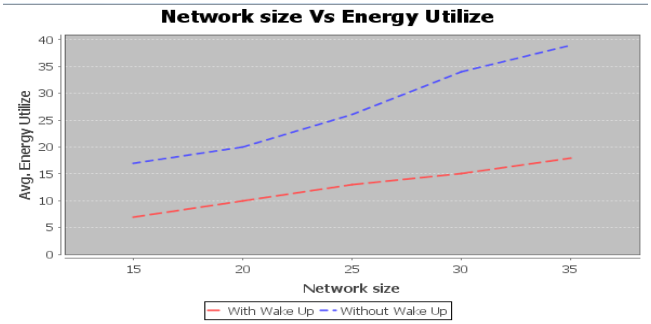

Fig. 3 Network Size with Wake Up and Without Wake Up

V. CONCLUSION

Nodes generally switch to sleeping mode to save the limited amount of available energy in sensor nodes, in wireless sensor network (WSN). Too periodically activation of the node is done by using sleep time interval. An on-demand wake-up scheduling algorithm which is used to activate the sleeping node on the path before data delivery is projected in this paper. We consider multi-hop communication in WSN, in this work. To improve the dependability of on-demand data forwarding and to enhance the performance, our work extends the SinkTrail solution by incorporating wake-up scheduling algorithm. By reducing corruption or loss of data due to sleeping nodes, the projected algorithm improves the quality of the service of the network. The efficiency and effectiveness of the projected solution are proved evaluation results.

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