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CERTAIN INVESTIGATION ON WAKEUP SCHEDULING IN WIRELESS SENSOR NETWORKS

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Abstract: - A Wireless Sensor Network is a collection of densely deployed autonomous devices, called sensor nodes, which gather data with the help of sensors Wireless Sensor Networks (WSNs) consist of small nodes with sensing, computation, and wireless communications capabilities. Many routing, power management, and data dissemination protocols have been specifically designed for WSNs where energy awareness is an essential design issue. The current researches & development in the wireless network is the main motivation for us to choose this topic. The focus, however, has been given to the routing protocols which might differ depending on the application and network architecture. In this paper, we present a survey of the state-of-the-art routing techniques in WSNs.
Wakeup scheduling is importance concept in wireless sensor network. Without wake-up scheduling energy con not save .efficient energy use in network required schedule the sensor nodes. So the Scheduling can be done in different ways.
Once a active sensor energy are loss then one of successor set node are active and sense data on that area. Using this approach we can find multiple-path from source to sink sensor after find multiple-path choose best path from source to sink. if any node in sleeping mode on the best path ,immediately wake-up for some time and then transfer data .so that delay minimize in source to sink. This achieving using wake-up scheduling .in propose system achieving minimize delay and efficient use of energy of network.

Keywords: - Wireless, Sensor, Networks, Wakeup Scheduling, Energy, Consumption.

1. INTRODUCTION

Due to recent technological advances, the manufacturing of small and low cost sensors became technically and economically feasible.The sensing electronics measure ambient condition related to the environment surrounding the sensor and transforms them into an electric signal. Processing such a signal reveals some properties about objects located and/or events happening in the vicinity of the sensor. A large number of these disposable sensors can be networked in many applications that require unattended operations.

A Wireless Sensor Network (WSN) contains hundreds or thousands of the sensor nodes. These sensors have the ability to communicate either among each other or directly to an external base-station (BS). A greater number of sensors allows for sensing over larger geographi-cal regions with greater accuracy.

Basically, each sensor node comprises sensing, processing, transmission, mobilize, position finding system, and power units (some of these components are optional like the mobilize). The same figure shows the communication architecture of a WSN. Wireless sensor networks are deployed in vast areas related to military &

civil applications such as target field imaging, intrusion detection, weather monitoring, security and tactical surveillance, distributed computing, detecting ambient conditions such as temperature, movement, sound, light, or the presence of certain objects, inventory control, and disaster management. Routing in WSNs is very challenging due to the inherent characteristics listed below:

1. Due to Large number of sensor nodes, it is not possible to build a global addressing scheme as in mobile ad hoc networks, for the deployment of large number of sensor nodes as the overhead of ID maintenance is high.

2) Sensor nodes are tightly constrained in terms of energy, processing, and storage capacities. Thus, they require careful resource management.

3) In case of some wireless networks where each sensor nodes are mobile that will results in unpredictable and frequent topological changes.

4) Sensor networks are application specific, i.e., design requirements of a sensor network change with application.

5) Position awareness of sensor nodes is important since data collection is normally based on the location. Currently, it is not feasible to use Global Positioning System (GPS) hardware for this purpose.

6) Finally, data collected by many sensors in WSNs is typically based on common phenomena; hence there is a high probability that this data has some redundancy.

Due to such differences, many new algorithms have been proposed for the routing problem in WSNs. These routing mechanisms have taken into consideration the inherent features of WSNs along with the application and architecture requirements.

2. ROUTING PROTOCOLS IN WSN

In this section, we survey the state-of-the-art routing protocols for WSNs. Different types of routing techniques can be classified as shown in Figure 2. Routing protocols can be classified depending upon Network structure or Protocol operation as shown in Figure2.Here we shall deal in detail the routing protocols based on network structure.

2.1. Flat Networks

In flat networks, each node typically plays the same role and sensor nodes collaborate together to perform the sensing task. Due to the large number of such nodes, it is not feasible to assign a global identifier to each node. This consideration has led to data centric routing, where the BS (Base station) sends queries to certain regions and waits for data from the sensors located in the selected regions.

Some of the protocols in case of flat networks are as below,

- Sensor Protocols for Information via Negotiation (SPIN),
- Directed Diffusion,
- Rumor routing,
- Minimum Cost Forwarding Algorithm (MCFA).

2.2. Hierarchical Networks

In a hierarchical architecture, higher energy nodes can be used to process and send the information while low energy nodes can be used to perform the sensing in the proximity of the target. This means that creation of clusters and assigning special tasks to cluster heads can greatly contribute to overall system scalability, lifetime, and energy efficiency. Hierarchical routing is mainly two-layer routing where one layer is used to select cluster heads and the other layer is used for routing.

Some of the protocols in case of Hierarchical Routing networks are as below,

- Threshold-sensitive Energy Efficient Protocols (TEEN and APTEEN)
- Virtual Grid Architecture routing (VGA)
- Hierarchical Power-aware Routing (HPAR)
- Two-Tier Data Dissemination (TTDD)

2.3. Location based Networks

In this kind of routing, sensor nodes are addressed by means of their locations. The distance between neighboring nodes can be estimated on the basis of incoming signal strengths. Relative coordinates of neighboring nodes can be obtained by exchanging such information between neighbors.

Some of the protocols in case of Location based routing networks are as below,

- Geographic Adaptive Fidelity (GAF)
- Geographic and Energy Aware Routing (GEAR):

- SPAN
- The Greedy Other Adaptive Face Routing (GOAFR)

3. RELATED WORK

In wireless networks, periodic wake-up is a convenient mean to avoid idle listening to the channel and to prolong nodes' lifetime. Typically, the duty cycle (defined as the fraction of time a node is in the active state) is set to values of the order of some percent. This is feasible when the data rate is low, i.e., on the order few packets per minute, as in low-rate wireless sensor networks. In order to schedule periodic wake-ups, a simple solution, adopted by BMAC and other WSN protocols, is to employ preamble sampling. Basically, the preamble is set long enough to guarantee node discovery at each wake-up.

In order to avoid inefficiencies, it has been proposed to match the RF interface activation, i.e., the sleep period, to the traffic pattern. This is the case of SMAC or TMAC protocols. In particular SMAC synchronizes the duty cycle by coordinating neighbouring sensors to the same slot to reduce the time spent listening to the channel. Adaptive change of the duty cycle is supported in TMAC, whereas matches duty cycles to the dynamics of the routing protocol. Tuning such protocols network-wide is typically not considered; scalability issues do indeed arise, due to the need of a potentially large amount of signaling messages. This is the core issue that we address in this paper: we design distributed algorithms for wake-up scheduling that present *linear* message complexity in terms of the network size *and* can operate local adaptation in case of nodes joining/leaving in a fully distributed fashion.

In ad hoc networks literature, centralized planning of wakeup schedules was addressed in several works. Solutions that are close to the ones proposed in this paper can be found in. In [4] the target is the design of power saving protocols for WiFi networks, using *quorums* design and leveraging the power-save mode provided by the IEEE 802.11 standard. In [11] methods for designing asynchronous and heterogeneous wake-up schedules are presented, where the heterogeneity may come from either different applications running or by different node-level features. Along the same line, provide solutions for creating wakeup schedules whereby the ability of neighbouring nodes to communicate (i.e., to be active in the same time interval) within a wake-up cycle is ensured by combinatorial means.

Some other works address the issue of network performance in the presence of duty cycles. The goal of such works is to maximize the throughput and minimize the delay, while meeting a given average power consumption constraint.

It is shown that the problem is, in general, NP-complete; an analysis is provided for regular topologies (line, grid and tree networks in [7], tree and ring networks in [8]). The distributed heuristic provided in [8] does not provide guarantees in terms
of delay bounds. Centralized approaches only are considered in.

In [20] the authors address the joint design of routing and wake-up scheduling protocols. The idea is that routing should be aware of the wake-up schedules and vice versa. A distributed implementation (based on the use of distributed versions of Bellman-Ford algorithm) is also possible. The need to coordinate routing and wake-up scheduling may create issues related to the amount of signaling messages to be exchanged in rapidly changing topologies.

4. WAKWUP SCHEDULING IN WSN

Wireless sensor network are emerging that include automation ,sensing , embedding computing previously wireless sensor network are applicable only monitoring application, environment monitoring , monitoring but now wireless sensor network(WSN) can be use in critical application such as health care industrial monitoring and automation . when WSN use in critical application two importance issues should be consider first issues lifetime of sensor node second issues is minimize delay .To increase the lifetime of WSN node we have to do the scheduling .Scheduling is nothing but technique which allow the some set of node should be in active mode and remaining node should be in passive mode but while doing we have to considering we have to take care it does not affect the system performance. In wireless sensor network application need a scheduling strategy .without scheduling strategy wireless sensor network application not work properly.

We can implement scheduling in way Wake-up scheduling, sleep scheduling, overload scheduling etc.

4.1 Sleep scheduling

Sleep scheduling is use to increase the battery lifetime of sensor node .sleep scheduling is apply to those node which having low power but some event happed that time it have to move from passive t state to active state . Sleep scheduling such way. So node should be in passive state for longer time so it can save the energy.

4.2 Wake-up scheduling

Wake-up scheduling is scheduling, in which node are move to active mode to transferring data form one node to another node wake-up scheduling classified in two parts.

4.2.1 Wake-up demand

The node is by default set to sleep mode only whenever some event happed are it require then node is move from passive state to active state

4.2.2 Wake-up on specific time

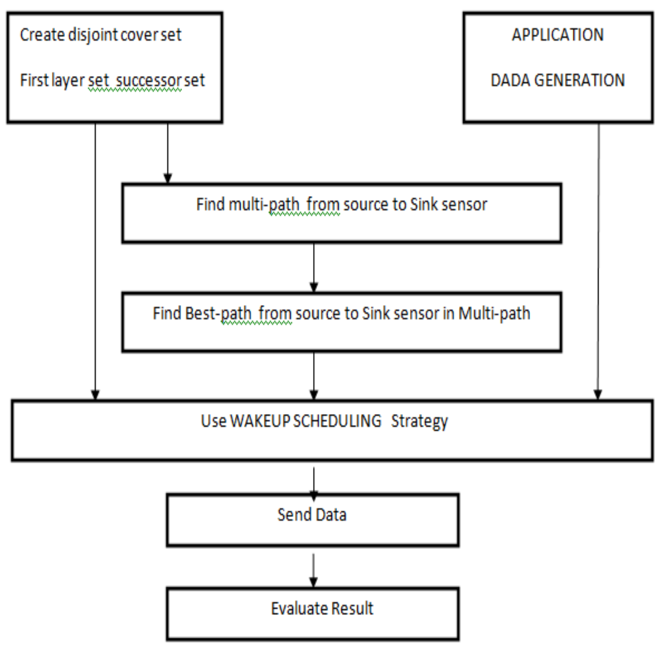
A node cannot be in any mode for infinite amount of time there is mechanize which has threshold values. When it reach threshold values that time only it have move to active mode.

5. PROPOSED SYSTEM

Wake-up scheduling is a challenging problem in wireless sensor networks. It was recently shown that a promising approach for solving this problem is to rely on reinforcement learning (RL). The RL approach is particularly attractive since it allows the sensor nodes to coordinate through local interactions alone, without the need of central mediator or any form of explicit coordination. This article extends previous work by experimentally studying the behavior of RL wake-up scheduling on a set of three different network topologies, namely line, mesh and grid topologies.

A relevant problem is to schedule the wake-up of nodes in such a way as to ensure proper coordination among devices, respecting delay constraints while still saving energy. In this paper, we introduce a simple algebraic characterization of the problem of periodic wake-up scheduling under both energy consumption and delay constraints.

We demonstrate that the general problem of wake-up times coordination is equivalent to integer factorization and discuss the implications on the design of efficient scheduling algorithms. We then propose simple polynomial time heuristic algorithms that can be implemented in a distributed fashion and present a message complexity of the order of the number of links in the network.



5.1: - Proposed System Architecture

5.1. Proposed Algorithm

In this section, we propose polynomial-time algorithms to produce valid compact wakeup scheduling for tree and grid topologies, which are commonly used in WSNs. Note that compact wakeup scheduling also exist in

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other types of graphs, such as line and hexagonal grid topologies, and the scheduling can be obtained using algorithms similar to that in tree and grid topologies.

Input: A tree $G = (V, E)$.
Output: A valid compact wakeup scheduling.

```
// Interval edge-coloring of a tree
Color any edge with 1.
while there are uncolored edges do
    Find a uncolored edge e whose end vertex v is adjacent to an already colored edge. Let
    {a, ··· , b} be the interval of colors assigned to v.
    if a > 1 then
        Color edge e with a − 1.
    else
        Color edge e with b + 1.
    end if
end while
// Time slot assignment
Map each color to two consecutive time slots, and use Algorithm 2 to determine a valid
direction of transmission assignment to avoid interferences.
```

We now describe how the interval edge coloring is used to assign time slots to each edge. The idea is to map each color to two consecutive time slots and assign a valid direction of transmission to avoid interferences.

6. CONCLUSIONS

In this paper, we address a new interference-free TDMA wakeup scheduling problem in WSNs, called compact wakeup scheduling. In the scheduling, a node needs to wake up only once to communicate bi-directionally with all its neighbors, thus reducing the time overhead and energy cost in the state transitions. In the case of graphs that have no valid compact wakeup scheduling, we define the compact wakeup deficiency of a graph to extend the scheduling to general graphs.

We propose polynomial-time algorithms to achieve the optimum number of time slots assigned in a period for trees and grid graphs. In grid graphs, we point out all the possible coloring patterns and give the lower bound as well as the upper bound of the compact wakeup scheduling. In the process of time slot assignments, both the hidden terminal and exposed terminal problems can be avoided. The simulation results corroborate the theoretical analysis and show the efficiency of compact wakeup scheduling.

In our future work, we will try to obtain efficient algorithms for other kinds of network topologies with valid compact wakeup scheduling. Another interesting problem is to design efficient (i.e. polynomial-time) heuristic algorithms to find an edge-coloring *c* in a graph *G* to make the compact wakeup deficiency of coloring *c* close to d(G) in general graphs.

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