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Enhanced Energy Efficient Routing by Sleep Scheduling Mechanism in Sensor Networks

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Abstract

Wireless sensor networks have now become a essential need now a days. To improve the energy efficiency, sensors functioning based on duty cycle. The duty-cycled WSNs with mobile sensors and propose two geographic-distance-based algorithms connected-k neighborhood (GCKN) sleep scheduling algorithms evolved. Wide range of traffic load also guarantees some shorter latency for critical and delay-sensitive packets. Performing joint congestion control and also scheduling with network coding in wireless sensor networks. Under network coding, a node may need to be buffer a sent packet for decoding a packet to be received later so on. If the sent packets are not forgotten smartly, then much buffer space will be taken up, that's leading to dropping of new incoming packets. To solve the problem, we introduce a scheduling procedure. Here we developed a new scheduling policy based on node model and analyze the stability property of a network system. In order to reduce packet loss ratio and improve network throughput, and reduce the energy consumption in wireless sensor networks, a scheduling scheme employed and to analyze the stability property of a network system.

Keywords: Duty cycle, geographic distance based algorithm (GCKN), energy, stability

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1. Introduction

In WSN energy is a very scarce resource. But WSNs have tighter requirements on network lifetime and recharging or replacing WSN node batteries and also to support longer lifetime an energy efficient operation is a key technique. In many scenarios the nodes have to rely only on a limited supply of energy. Replacing these energy resources is usually not practicable. Hence, an energy efficient way of operation of the WSN is necessary. Therefore more energy have to be saved in a better way and also to minimize the wastage of energy level many energy saving mechanisms have to be evolved.

2. Routing Protocols

The AODV protocol is both an on-demand and a table driven protocol. The packet size in AODV is uniform unlike DSR. It supports both unicasting and multicasting. Each route has a lifetime after which the route expires if it is not used and a route is maintained only when it is used and hence old and expired routes are never used. Unlike DSR, AODV maintains only one route between a source to destination pair. AODV attempts to improve on DSR by maintaining routing tables at the nodes, so that all the data packets do not have to contain routes.

2.1. *Disadvantages*

- Local minimum problem arise due to nodes present nearby sink.
- Sink mobile information is flooded only on demand
- Each node should not have enough initial neighbors in order to make it easier for the node neighbor node requirement.

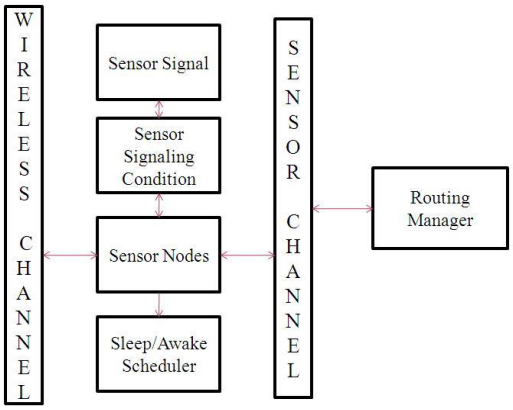

Fig.1 System Architecture

2.2. *Problem Identification*

The sensed amount of data transmitted have to reach the base station BS, within a certain time period or before the expiration of a deadline.

3. Proposed System

In the proposed system, the sleep/awake scheduler mechanism is used based on duty cycle approach. Also, if any path got failure it automatically choose alternate path for the transmission. This can be done by splitting the sleep time into random sleep time and periodic sleep time. Hence, maximum energy can be saved during the transmission phase. By make use of this scheme the better quality of service can be obtained. The node is kept

on/off state depends on the sensor signaling condition as well.

3.1. Advantages

- Local minimum problem is solved
- Sink mobile information flooded when it moves its position
- All nodes can have the equal opportunity to sleep and avoid without staying awake all the time.

3.2. System Design

From fig.1the sensor node is the node that is the central unit in the network. That is the intermediate to the sensor channel and the wireless channel. That is linked with the sensor signaling condition that will check the signal strength value of the sensor node and process the sensor signal.

The sleep/awake scheduler makes the sensor node as active or sleep state. The routing manager is used to find the best path from the source to destination nodes.

3.3. Modules Description

3.3.1. Sleep/Active Control

In general, wireless sensor nodes faced with a maximum energy constraints as it is exposed to large data transmission and reception in variety of scenarios.

The technology of power saving is separated into four study aspects :-

- The scheduling of sleeping and awakening of sensors is highly preferred to achieve the energy preserving by sleeping mechanism.
- Here, all the nodes are awake only during its transmission time and rest of the time it is in sleep mode
- It is suitable also for multipath transmissions, it has a effective routing path for destination via the sink nodes when needed.
- It reduces the overhead of data, the nearest nodes will be set to sleep state to avoid the happening of overhead

3.3.2.Random Sleep Time

The time duration of active and sleep status is unfixed for each duty cycle. In this manner, it will reduce the performance for the data transmission delay or leads to wastage of energy for the long active duration with no data transmission.

3.3.3periodic Sleep Time

In periodic sleep time, introduce S-MAC (Sensor Mac) and T-MAC. The periodic sleeping mechanism can avoid the overhead of the sensor node, the nodes are prevent from the collision, reducing idle time.

3.3.4The Optimal Sleep Control For Wireless Sensor Networks (Osc)

The frequency of relay of the sensor nodes nearest from the sink is reduced through raising probability of sleeping of the sensors farthest from the sink. From fig.2 the algorithm is divided into four stages: 1) establish a network, 2) set the probability value for each sensor node of every level 3) built the energy table, and 4) assemble the sensor nodes according to the node energy level. In the initial stage of establishing network, sensor nodes are distributed based on their sink as center of the circle with radius R.

After the initial stage, the probability of entering the sleep mode of the sensor nodes in each level is established. The probability is Figure out via the distributive density of sensor nodes and then the sensor nodes in each level will be decided to sleep or awake It is possible to adjust the sleep and active duration time according to the remaining energy of sensor nodes. It will save much power of sensor nodes and will make extend the life time of the entire wireless sensor networks.

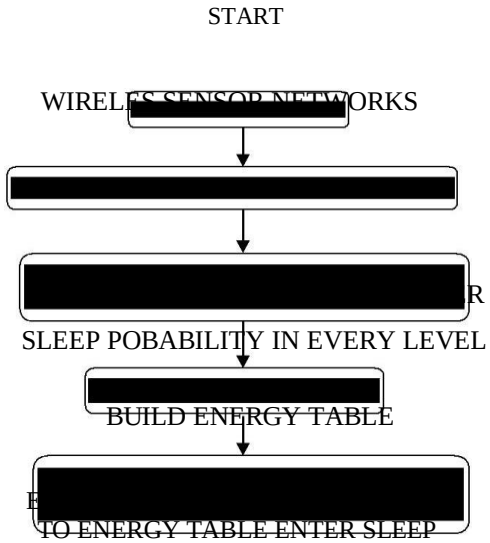

Fig.2 The Optimal Sleep Control Chart

In the improved Sleep Scheduling implemented all the node can sleep and awake at same time and same interval, if it not has any data. In case, any node has the data to send to base station then sender and receiver should be in active mode, remaining all the node can go to sleep. To make synchronization between sender and receiver and neighbour node use RTS/CTS.

Here the total time is divided into slots, and further slots into sub slots. Each node synchronized timer, so each nodes knows when the time slot begins and ends. All the nodes will be in idle listen mode at beginning of each time slot. If any node has data then the node will check the slot availability in sub slot. If node has high priority data then it can make use of the first sub slot, or its own slot means second sub slot or else third sub slot.

4. Simulation Results

The nodes are placed in such a way to perform the data transmission in sleep/awake mode. Fig.3 shows the result of allocated time slot for each node. From Fig.3 we can see the virtual clustering model of 2 hop nodes. If one slot is allocated by other node means prev/next two nodes can't be access the same time slot at a time.

So each node aware about next hop node one two hop node information also known as (virtual clustering) message sharing from base station .

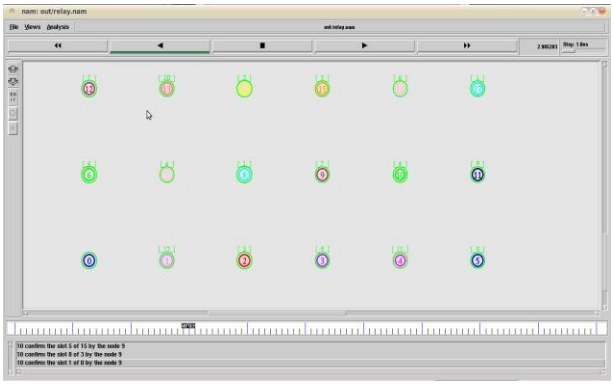

Fig.3 Allocated time slot for each node

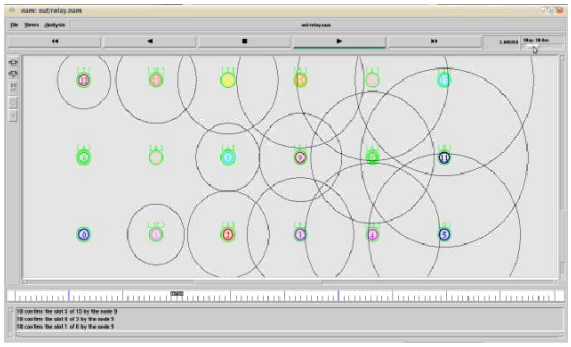

Fig 4. Base station shares the originating message after time slot allocation

Initially we divided time into time slots and next we divided time slot into further three slots (priority slot, own slot, and other slot). If any node has any priority data then the node can transfer the data at beginning of time slot which may be its own or other nodes. If node not has any priority data then it will check for slot is for me or not. If any slot is its own slot then it may send data in second slot of main slot. If slot is others slot then it will wait for third slot in main slot with small minimum random interval if node not detecting communication then node can transfer the data in that slot. Fig.5 shows the result of data transmission through other slot

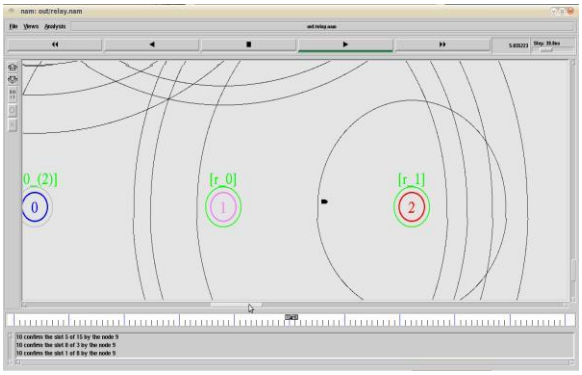

Fig.5 Data transmission in other slot (if slot is free)

In Basic SMAC, if the node has the data or not it should work for predefined time duration. So power loss is more than our model. We have done the power control with periodic sleep and at the same time variable period depends on the data usage. So we can see the power saving improvement at each implementation like TDMA, priority and IHMAC without power control and with power control. By the
power control mechanism we have improved power saving (fig.6)

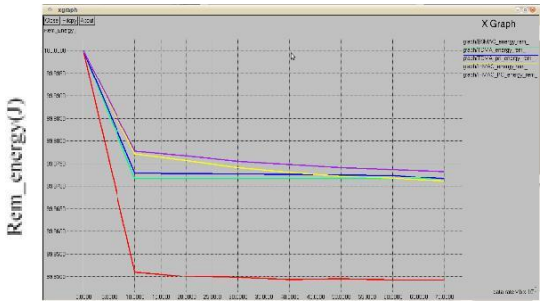

Fig.6 Comparison of energy level

This project which is slightly differ from our base IHMAC system, in our base model they have considered extra synch packet to control the sleep and awake mode. But in our implementation we have not used extra synch packet. We used RTS and CTS to control the sleep mode. So we can avoid unnecessary overhead.

5. Conclusion

Energy is one of the scarce resource for WSNs. Most of works in the literature surveys about WSN routing have emphasized energy savings as an important optimization goal. However, merely saving energy is only not enough to effectively enlarge the network lifetime. The distributed energy depletion that may often results in network partition and low coverage ratio, which deteriorate the performance. We mainly focussed on minimizing energy consumption and maximizing network lifetime to optimize the network energy efficiently by marking the differences among sensor nodes in terms of both their distance to sink and residual energy of each other. The main objective is to reduce packet loss ratio and improve network throughput, and to minimal the energy consumption in wireless sensor networks, a scheduling scheme employed based on our node model and analyze the stability property of a network system. This will prolong the lifetime of the network. The proposed routing algorithm was extended to sleep mode as well and therefore a longer network lifetime can be achieved. Apart from that, an analytical survey of the new energy model include sleep mode will be performed.

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