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Semi-Synchronous Sleep Calendar Mechanism in Wireless Sensor Networks and Intelligent Systems

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Abstract
Wireless sensor network facing the problem of battery drainage, to reduce the battery consumption in the idle state of the node. This problem can be overcome by the use of the solution sleep scheduling mechanism. Sleep scheduling mechanism is also called as duty cycling which perform the operation of on and off a sensor node when needed. Sleeping scheduling is the reliable mechanism to expand the life of the wireless sensor node.

Keywords: Wireless Sensor Networks, Sleep Patterns, Consumption, Scheduling, Transition

1. Introduction

In order to achieve optimal sleep, the system needs to propose a single state transition schedule for all sensors. The proposed methodology consists of three main steps; optimally selecting the maximum sleeping time window, dynamically determining whether a sleeping sensor should enter a low power state or operate in its normal mode and according to whether a sensor is in low power state or not, and communicating this information to all other sensors. The methodology is found to be effective in reducing the energy usage, increasing the network lifetime and achieving a balance between data gathering and the end-to-end latency requirements.

The semi synchronous sleep schedule is a technique used to synchronize the sleep schedules of sensors. The sensor sleeps for a specific amount of time and wakes up at the next perfect time (called as pre-determined time). The start times chosen are based on an end-to-end delay model. It minimizes the utility of each sensor by allowing only some sensors to do any useful work during sleeping time. The sensor is asynchronous with respect to the rest of the system; in fact, it wakes up at its own time and proceeds to collect data and transmit it at its own time. A semi-synchronous sleep schedule (SSS) is the combination of a single send interval followed by a single receive interval.

Semi Synchronous sleep schedule have been used in multiple scenarios: vehicle tracking, factory automation, control systems, etc. However, when the system relies on sending data over some medium other than wireless networks.

2. Literature Survey

With the rising popularity of wireless sensor networks, this paper reviews literature on research related to semi-synchronous sleep schedule in wireless sensor network. The paper reviews the research and available free resources which are beneficial for future designers and developers of wireless sensor network system with specific consideration to semi-synchronous sleep schedule. The article discusses advantages and disadvantages, challenges and possible solutions of this type of architecture design as well as future work or research areas to be investigated.

Zeyu Zhang et al [1], conducted a short review on sleep scheduling mechanism in wireless sensor network. In this research paper have the short note about all three sleep scheduling mechanism

of wireless sensor node they all synchronous, semi-synchronous, asynchronous. This paper clearly demonstrates algorithms of sleep schedule in WSN. Renato Lo Cigno et al, [6], 2008, did a research on Semi-Synchronous, Energy Savvy, Application-Aware MAV 2008. This work presents the approach for energy saving in mac protocol for WSN. It provides the gaze for distributed, loose coordination of node. Li-yonh Yuan et al [2], 2018, designed a novel approach on improved Asynchronous energy mechanism. Yan Wu et al [3], invented a mechanism on optimal sleep/wake scheduling for time Synchronizes sensor network with QoS Guarantee. Yang D et al [4], 2010, invented a method of RW-MAC: an asynchronous receiver-initiated ultra-low power MAC protocol for wireless sensor networks. Fedrick Isaksson [5], 2014, did a study on synchronous sleep in a wireless mesh network. Y.Wang et al [7], 2016, designed an algorithm on an Energy-efficient SDN based sleep scheduling algorithm for WSN. Y. Xu et al [8], 2015, given an approach to cluster sleep Scheduling mechanism based on sentinel node monitor for WSN. The paper discusses the novel approach to Semi-Synchronous Sleep Calendar Mechanism in Wireless Sensor Network in Intelligent Systems with the assistance of various intelligent approaches.

3. Proposed Methodology

The semi-synchronous mechanism is one of the improved mechanism than Asynchronous. In semi-synchronous each node performs the function of wake up and sleep schedule of its two neighbours. The main operation is to calculate the upcoming wake up time of a particular node. After known upcoming time of a receiver node, it is easy for the sender node. The sender node will power up radio sooner than receiver wake up time, this process considerably reduces the energy waste from idle listening state.

The action and frame transmission of are maintained by a mesh sublayer parameters meshASESon by a mesh sublayer parameters meshASESon it helps to identify whether a node is under the ASES or not, in start all node sets value to false, that defines nodes will from the network in spite of asynchronous energy saving (ASES) mode specifically all the functionality of request, response, address report and allocation of a frame are transmitted in typical form. When mesh sublayer received the message, the node can select a wake-up time erratically and node can send multiple

eHellow message to notify its acquaintance of its wake/sleep scheduling. The below figure – 1 represents the proposed methodology.

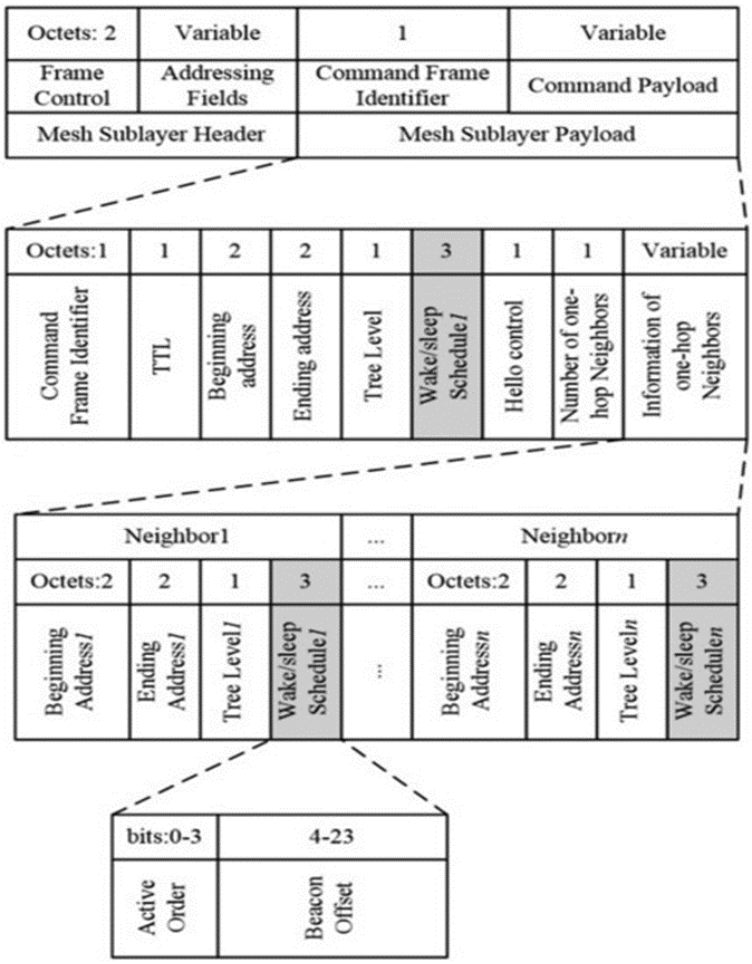

Figure – 1: Configuration of eHellow frame

The eHellow message frame incorporate the schedule of the sending and one-hop neighbour it is represented in grey coloured frame in the figure 1.Every acquittance of the node and its wake/sleep schedule contains its active order wireless network offset of the comparative to the current node. The wireless offset is measured by meshTimeUnit(mTU) which is constant value 1ms, maximum of wakeup interval(WI) being 5*12mTUs.Its need 16 bit to hold the wireless network offset ,3 bytes is used to accommodate a node wakes sleep schedule .4 bits are for AO and the lest bits are used for wireless offset.

Esteem mTU as a time slot. A wake up interval (WI) which can be divided into L time slot here L=5*2wo. There will be two neighbour u and v and node v can calculate the WN offset of node u correspond to itself is shown in the below equation (1).

$$Ovu=(i-OuL)modL \quad \text{---------} \quad (1)$$

Let's I symbolize number of slots in which node v received the eHellow message send by the particular node u.

Ou represent the number of the n node send the eHellow message.

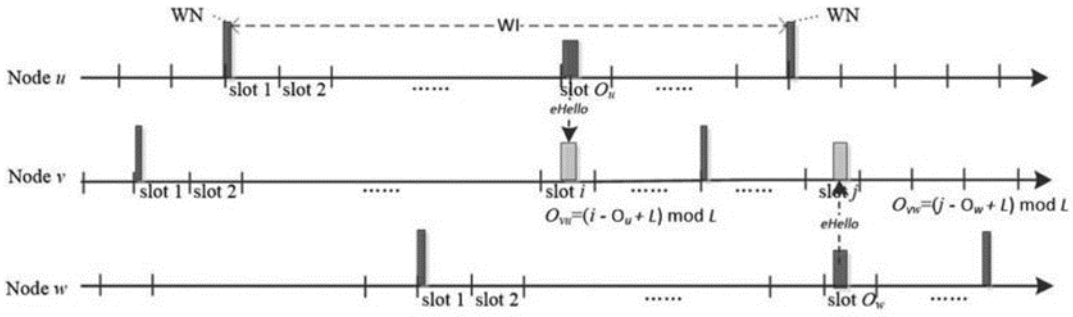

Figure – 2: Calculation of WN offset between two neighbors.

In case any node found that its WN slot is same with those of its neighbor, the node can have ability to select a new WN slot as concerning neighbour. When node receive eHellow message from the corresponding node it can enter ASES mode by setting meshASESon value as TRUE, and start function in duty cycle.

For the purpose of storing the information of node in two-hop neighbour, each node continues a two-dimension table, called extended neighbour list, it's also known as EN-list. EN-list contain the attribute of begin address, End address, tree Level, link Quality, relation, status, numOfHops and wake sleep schedule.

Here begin address and end address represents beginning and end address of the address block assign to the nodes in neighbour, Tree level symbolize tree level of neighbour, tree level in routing tree is equal to 1 and if the tree level in sink is equal to 0, link quality represents the link between

neighbour and the current node. Their status can indicate by the value unknown, down and Left and its support the leaving and re-joining of nodes, the relation between the current and neighbour node is symbolize by the relation field values that is parent, child and common neighbour, numofHops is the number of hops between the node and neighbour and AO represents the wake/sleep schedule of neighbor.

The node maintains the wake/sleep schedule of all neighbor node in Enlist. then its easy task to calculate the WN time of the particular interested node. here if the data indicated by u has data deliberate to a neighbor denoted by v,it calculate the WN slot of node v by reversing the WN offset calculation Bv=Bu+Ouv, where Bu is the WN slot of node u, for the transmission of information packets the intended node is remains to be active at the moment and it should be remain active, for the transmission of packets ,otherwise node will wake up earlier than the actual wake up time .After receiving the WN from the intended node it can start connect channel for send.

In the below figure 3, replicates how the unicast mechanism of semi- synchronous acutely reduce the idle listening time of the sender, helps to improve energy efficiency.

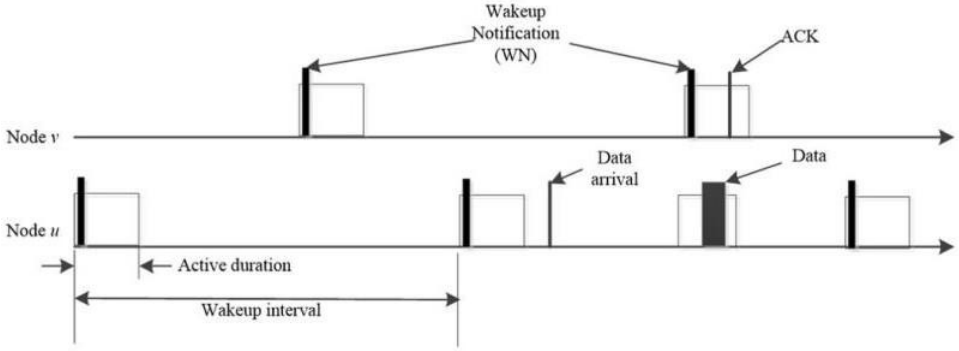

Figure – 3: Unicast mechanism of semi-Synchronous

4. Conclusion

The proposed methodology achieves asymptotically optimal performance as compared to existing semi synchronous sleep schedule-based schemes. In this mechanism sensor nodes are arranged in synchronized group. Mechanism nodes wake up or sleep time is same. Nodes exchange the information with periodic wake/sleep interval. Consultative the wake/sleep schedule of neighbour if the node has data to be send it will calculate the Wake up Notation(WN) time of the neighbour and

turn on the radio little earlier than the calculated WN time of the receiver, this mechanism helps to reduce energy consumption in idle state.

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References

1. Zeyu Zhang, Lei Shu, Chunsheng Zhu and Mithun Mukerjee A Short Review on Sleep Scheduling mechanism in wireless sensor network.
2. Li-yonh Yuan, Fei-Long Lin, Juk-Ke Lv an improved Asynchronous energy mechanism for IEEE 802.15.5-based network, September 24,2018.
3. Yan Wu, Sonia Fahmy, Ness B.Shroff Optimal sleep/wake scheduling for time Synchronizes sensor network with QoS Guarantee.
4. Yang, D, Qiu, Y, Li, S. RW-MAC: an asynchronous receiver-initiated ultra-low power MAC protocol for wireless sensor networks. In: Proceedings of the IET international conferences on wireless sensor network, Beijing, China, 15–17 November 2010, pp.393–398. New York: IEEE.
5. Fedrick Isaksson Synchronous sleep in a wireless mesh network, Stockholm, Sweden 2014.
6. Renato Lo Cigno, Matteo Nardelli, Michael Welzl A Semi-Synchronous, Energy Savvy, Application-Aware MAV 2008.
7. Y.Wang , H.Chen , X.Wu and L.Shu, “An Energy-efficient sdn based sleep schedulings algorithm for wsn,” 2016.
8. Y. Xu, G. Zhao and J. Jing “A cluster sleep Scheduling mechanism based on sentinel node monitor for wsn” ,2015.