ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

An Effective Energy Utilization Scheme using Distribution Time Synchronization Algorithm.

Sakthi Prabha R*

Dept of Electronics & Communications Engineering, Sathyabama University, Chennai, India

ABSTRACT

In this paper, to decrease the transmission delay in wireless sensor network and actor we use the energy from the neighbor nodes. Energy consumption is important but they have limited energy and makes heavy network traffic. To cope with this issue we suggested Distributed Time Synchronization algorithm. Proposed algorithm is distributed and hence it solved the problem to a considerable level. In this algorithm, every distinguished node send time value along its traversal periodically, the traversal is done through Spanning Tree. One of the most important advantage of this algorithm is purely distributed and local. It does not depend a fixed structure, as it has disseminating values. In conclusion, the result gained shows that the suggested protocol reduced energy consumption upto 30% when compared to the exisiting approaches.

Keywords: Wireless Sensor Network; Transmission Delay; Time Synchronization; Clock Synchronization: Time Delay

**Corresponding author*

INTRODUCTION

Over the last two decades, wireless sensor networks (WSNs) have emerged as an effective solution for a wide range of applications, such as environment monitoring, smart grid, vehicle navigation, transportation, smart building, process industry, healthcare services and so on. Smart Grid deploys advanced communication technology to establish two-way communication networks connecting the service provider and the customers beyond the traditional power grid architecture [1], [2]. The sensor networks have provided us with several applications in wireless environments but have more problems and they must be resolved [3,4]. Time synchronization is a critical piece of infrastructure in any distributed system. In sensor networks, a confluence of factors makes flexible and robust time synchronization particularly important, while simultaneously making it more difficult to achieve in traditional networks. Time synchronization is a critical piece of infrastructure for any distributed system. Distributed wireless sensor and actor networks (WSAN) make particularly extensive use of synchronized time. For example, to integrate a time-series of proximity detections into a velocity estimate [5]; to measure the time-of-flight of sound for localizing its source [6]; to distribute a beam forming array [7]; or to suppress redundant messages by recognizing that they describe duplicate detections of the same event by different sensors [8].

Sensor networks also have many of the same requirements as traditional distributed systems: accurate timestamps are often needed in cryptographic schemes, to coordinate events scheduled in the future, for ordering logged events during system debugging, and so forth. WSANs are large-scale distributed systems, yet their unique characteristics, especially the severe resource constraints, require the reevaluation of traditional distributed algorithms for problems once considered to be solved. One of the basic middleware services of sensor networks is time synchronization. Time synchronization is required for consistent distributed sensing and control. Furthermore, common services in WSN, such as coordination, communication, security or distributed logging also depend on the existence of global time. The many uses of synchronized time in a sensor network make it critical. However, the diversity of these roles also makes synchronization a difficult problem to solve. Application requirements vary widely on many axes, such as precision, lifetime, scope, availability, and energy budget. For example, acoustic applications require precision of several microseconds, while sensor-tasking works on the time scale of hours or days. Local collaborations often require only a pair of neighbors to be synchronized, while global queries require global time. Event triggers may only require momentary synchronization, while data logging or debugging often require an eternally persistent timescale. Communication with a user requires an external, human timescale, whereas only relative time is important for purely in-network comparisons. Some nodes have large batteries and run all the time; others are so constrained that they only wake up occasionally, take a single sensor reading, and transmit it before immediately returning to sleep. A paradox of sensor networks, then, is that they make stronger demands on a time synchronization system than traditional distributed systems, while simultaneously limiting the resources available to achieve it. This paradox has made current synchronization schemes inadequate for the task. To solve such a problem, distributed algorithm based on tree structure for synchronization in WSAN is suggested in the paper.

RELATED WORKS

Several good tutorial papers on cooperative transmission have been published (e.g., [9] and [10]). As most of the current works look at the cooperation from the transmitter side only, our paper differs in that our communication model includes groups of cooperating nodes at both sides of the transmission link with the purpose of reduction in energy consumption. Similar to multiple-input–multiple-output (MIMO) communications, the main gain of cooperative transmission comes from the fact that there is limited correlation between communications from different transmitters. The increase in the degree of freedom of signal detection decreases the bit error rate [11]. Consequently, the gain of cooperation is similar in nature to what is achieved by MIMO techniques. Of course, there are substantial differences in the environment and in the operation between cooperative transmission and MIMO. In the MIMO systems, each node is equipped with multiple antennas. Information is transmitted from the sender node by multiple antennas and received by multiple antennas at the receiver node [12], [13]. The close proximity of the antennas at the transmitting nodes and of the antennas at the receiving nodes makes synchronization easier to implement [14]. The ability of nodes to sense the carrier and to measure the interference level can be used to decide on the number of antennas that are employed for transmission. On the contrary, in cooperative transmission, the synchronization of transmissions of the relatively dispersed cooperating nodes necessitates a more elaborate protocol [15]. A protocol is also required to identify the neighboring nodes as potential cooperators and to make a selection of the cooperating nodes. Moreover, due to the geographical dispersion of the cooperating nodes, the protocols in cooperative networks need to be distributed in their operation. In [16], a MAC protocol for MIMO systems is described, which is based on centralized cluster architecture. This protocol uses clustering mechanisms like LEACH [17]. Nodes in a cluster cooperate to forward the data to only the next cluster head on the path to the sink. However, the centralized architecture leads to higher energy usage for the cluster maintenance. In contrast, distributed mechanisms are more efficient in the cluster maintenance operation and lack the single-point-of failure vulnerability. Thus, they may be better suited for sensor or mobile networks. Time synchronization algorithms provide a mechanism to synchronize the local clocks of the nodes in the network and extensively studied in the past. The most widely adapted Protocol (NTP) devised in [18]. The NTP clients synchronize their clocks to the NTP time servers with accuracy in the order of milliseconds by statistical analysis of the round-trip time. The timeservers are synchronized by external time sources, typically using GPS. The NTP has been widely deployed and proved to be effective, secure and robust in the internet. In WSN, however, non-determinism in transmission time caused by the Media Access Channel (MAC) layer of the radio stack can introduce several hundreds of milliseconds delay at each hop. Therefore, without further adaptation, NTP is suitable for WSN applications with low precision demands. Two of the most prominent examples of existing time synchronization protocols developed for the WSAN domain are the Reference Broadcast Synchronization (RBS) algorithm [19] and the Timing-sync Protocol for Sensor Networks (TPSN) [20]. In [21]suggests that, for some applications, the time of events can be described in terms of their age rather than as an absolute time. In essence, when two nodes exchange a message that describes an event in terms of age, the time at which the message itself is sent becomes a common frame of reference for time. The notion of "now" at the instant a message is sent is inexact, due to nondeterministic and asymmetric latencies; this is an important source of error. In the long term, error is dominated by frequency differences among nodes; the effect is magnified as timestamps age. Furthermore, they analyzed the scheme and conclude that a nominal precision of 1ms. In [22] describe the Time Diffusion Protocol (TDP), for achieving global time synchronization in sensor networks. Their work has a number of strengths, including an automatic self-configuration through dynamic topology discovery.

In addition, they quantitatively analyze the energy cost of their scheme. In the RBS, a reference message is broadcasted. The receivers record their local time when receiving the reference broadcast and exchange the recorded times with each other. The main advantage of RBS is that it eliminates transmitter-side non-determinism. The disadvantage of the approach is that additional message exchange is necessary to communicate the local time-stamps between the nodes. The focus of our work is on methods of clock synchronization, not on the construction of better clocks. However, clocks are very important: the error bound achieved by a clock synchronization method is linked to both the error inherent in the method itself, and the stability of the clocks' frequency standards. In fact, to some extent, the two are interchangeable. Stable clocks can compensate for a synchronization channel between them that is prone to large (but unbiased) errors: many synchronization events can be averaged over a long time. Similarly, a precise synchronization channel can compensate for a poor-stability frequency standard; frequent synchronization minimizes the time in-between when the clock is left to fend for itself. Many types of frequency standards exist. In general, as their stability and accuracy increase, their power requirements, size, and cost are important in sensor networks. Most commonly found in computer clocks are quartz crystal oscillators, characterized in [23]. Quartz crystals are attractive because they are inexpensive, small, use little power, and perform surprisingly well despite their low resource requirements.

EXISTING MODEL

In co-operative networks transmitting and receiving between the nodes re-writing the neighbor nodes to assist in communication. They have proposed a co-operative communication protocol for creating the clusters. After creating the clusters laid communication between them. The clusters were classified into transmitter and receiver cluster. The communication was based “one-node-thick” route from the source node to the sink node implemented using Ad hoc On-Demand Distance vector routing protocol. This work focused mainly on recruiting and transmitting phase, in which it recruits the neighbor node and starts the transmission. Analysis of energy consumption of the transmissions of the control and data packets between two co-operative clusters of nodes with their calculative clusters. As it takes probability to calculators communication between the cluster and clusterification, it has failed results also.

The data packet rate has the capacity to increase the rate at each second. Due to its upper bound on capacity. It determines the capacity upper bound for one hop. We divide the number of bits in the data packet transmitted in one hop by the minimum delay needed to complete this transmission. Expected performance can be achieved by repeatedly doing the simulation. Using the clusterification they reduced the energy required to send the data without loss. Robustness of the protocol also be analyzed. But it needs more time to search, recruit and then transmit the phase. So, we will forwarding the research into time-based efficient scheme.

PROPOSED METHODOLOGY

As described in the derivation for the influence field and the size of the classifier window, we require that observations occurring at the same physical time need to be time stamped with values differing by not more than 5 ms in order to achieve the desired classification accuracy. This imposes an accuracy requirement on the time synchronization service, i.e., the time values of any two nodes in the network cannot differ by more than 5 ms at anytime instant, which translates to a per-hop accuracy of less than 500 ls. An important requirement of the time synchronization service is that it should be robust to node and link failures. Our first implementation of time synchronization was based on the traditional spanning tree based algorithm for synchronizing clocks. In this algorithm, a distinguished node periodically sends time values along a spanning tree structure. We used the spanning tree structure that it is based on reference [24]. However, this algorithm, while providing good accuracy, suffers from the drawback of depending on a relatively static structure for time dissemination and hence performs poorly in the presence of unreliable nodes and links and network partitions. For this reason, we designed a truly distributed time synchronization service that is robust to these commonly occurring faults in sensor networks. The basic idea behind our time synchronization algorithm is that of locally synchronizing to the fastest clock. In this scheme, each node maintains a local clock, which is never changed, and an estimate of network time that is stored as an offset with respect to the local clock. Each node broadcasts its network time value periodically and receives time values from its neighbors. If a node receives a time value greater than its own, it adjusts its local time to that value; otherwise, it ignores the received value. Thus, the entire network synchronizes to the maximum clock value in the network. This scheme also guarantees that the timestamp values at every node are monotonically increasing. This time synchronization algorithm is purely distributed, local, and does not depend on a fixed structure for disseminating time values. Consequently, even if a single node or link fails, the other nodes can receive time values from the rest of their neighbors. Thus the protocol is robust to individual node and link failures. Node joins are also easy to handle as the new nodes have lower time values and hence catch up with the rest of the network and do not force other nodes to roll back their clocks.

SIMULATION MODEL

Our experiments demonstrate that the basic time synchronization algorithm meets the level of accuracy desired by the application, as can be seen from Figure 3. Our results also show that accuracy improves significantly when time synchronization is implemented as close to the hardware level as possible. Moreover, accuracy can be further improved using skew compensation techniques. It should be noted that in large-scale networks, where the amount of message traffic received is high, processing time synchronization values at the level closest to hardware could be risky. Because of the overhead of extra computations at the lowest level, processing of time synchronization messages might be preempted by other low-level events resulting in arbitrary state corruptions if not programmed or scheduled carefully. The simulation results of DATS are compared with CAN[7,12]. The result of comparison is shown in the figure 1. We demonstrated the results graph by 50 sensor node.

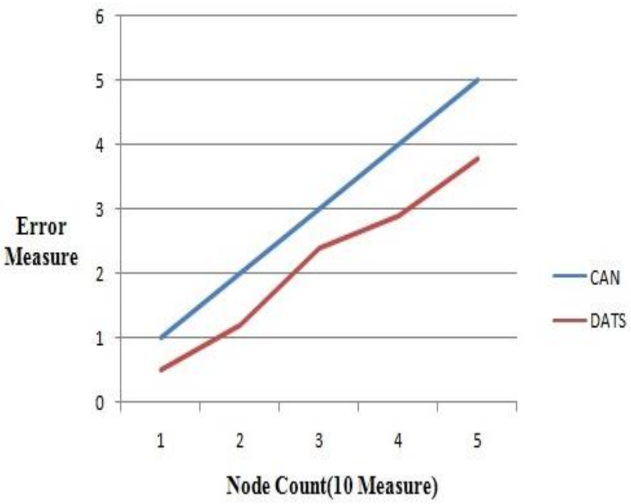

Fig 1: Exist Error in network and compare CAN, DATS.

CONCLUSION

In this paper, an algorithm to decrease transmission delay in WSAN was introduced and discussed. We have described the distributed algorithm for time synchronization in WSAN. The protocol was implemented on the MATLAB software. The DATS was tested and its performance was verified in a real world application. This is significant because the service had to operate not in isolation, but as part of a complex application where resource constraints as well as intended and unintended interactions between components can and usually do cause undesirable effects. Moreover, the system operated in the field for extended periods and not under laboratory conditions. This is a testimony to the robustness of the protocol and its implementation.

REFERENCES

[1]. Y. Yan, Y. Qian, H. Sharif, and D. Tipper, “A survey on smart grid communication infrastructures: Motivations, requirements and challenges,” IEEE Commun. Surv. Tuts., vol. 15, no. 1, pp. 5–20, Feb. 2013.

[2]. R. Ma, H. Chen, Y. Huang, and W. Meng, “Smart grid communication: Its challenges and opportunities,” IEEE Trans. Smart Grid, vol. 4, no. 1, pp. 36–46, Mar. 2013.

[3]. Kiani, F., Rad, A., Sis, M.K., Kut, A. and Alpkocak, A. (2013). "EEAR: An Energy Effective-Accuracy Routing Algorithm for Wireless Sensor Networks”, Life Science Journal 2013, vol.10, no.2, pp. 39-45, 2013.

[4]. Kiyani, F., Tahmasebirad, H., Chalangari, H. and Yari, S. (2010). "DCSE: A dynamic clustering for saving energy in wireless sensor network”, International Conference on Communication Software and Networks, vol.10, pp.13-17, 2010.

[5]. Hein Zelman, W.R., Chandrakasan, A. and Balakrishnan, H. (2000). "Energy efficient communication protocol for wireless networks”, In Proceedings of the 33rd System Sciences Hawaii International Conference. vol.2., pp. 1-10, 2000.

[6]. Ganeriwal, S., Kumar, R. and Srivastava, M. B (2003). "Timing- Sync protocol for sensor networks”, The First ACM Conference on Embedded Networked Sensor System (SenSys), vol.3, pp.138$149, 2003.

[7]. Mills, D. L(2001). "Internet time synchronization: The Network time protocol”, IEEE Transactions on Communications, Vol, 39, no. 10, pp. 1482$1493, 2001.

[8]. L. Gemua (2004). Development of an acoustic rangefinder. Technical Report 00-728, University of Southern California, Department of Computer Science, 2004.

[9]. Stefanov and E. Erkip, “Cooperative information transmission in wireless networks,” in Proc. Asian–Eur. Workshop Inf. Theory, Breisach, Germany, Jun. 2002, pp. 90–93.

[10]. T. Hunter and A. Nosratinia, “Diversity through coded cooperation,” IEEE Trans. Wireless Commun., vol. 5, no. 2, pp. 283–289, Feb. 2006.

[11]. J. Laneman and G. Wornell, “Distributed space-time-coded protocols for exploiting cooperative diversity in wireless networks,” IEEE Trans. Inf. Theory, vol. 49, no. 10, pp. 2415–2425, Oct. 2003.

[12]. P. Herhold, E. Zimmermann, and G. Fettweis, “Cooperative multi-hop transmission in wireless networks,” Comput. Netw., vol. 49, no. 3, pp. 299–324, Oct. 2005.

[13]. Nosratinia, T. E. Hunter, and A. Hedayat, “Cooperative communication in wireless networks,” IEEE Commun. Mag., vol. 42, no. 10, pp.74–80, Oct. 2004.

[14]. H. Shen and S. Kalyanaraman, “Asynchronous cooperative MIMO communication,” in Proc. IEEE WiOpt, Limassol, Cyprus, Apr. 2007, pp. 1–9.

[15]. D. Hoang and R. Iltis, “An efficient MAC protocol for MIMO-OFDM ad hoc networks,” in Proc. IEEE Asilomar Conf. Signals, Syst. Comput., Pacific Grove, CA, Oct. 2006, pp. 814–818.

[16]. K. Sundaresan, R. Sivakumar, M. Ingram, and T. Chang, “A fair medium access control protocol for ad-hoc networks with MIMO links,” in Proc. IEEE INFOCOM, Hong Kong, Mar. 2004, vol. 4, pp.2559–2570.

[17]. J. E. Kleider, G. Maalouli, and X. Ma, “Timing synchronization in distributed mobile MISO Rayleigh fading channels,” in Proc. IEEE MILCOM, Orlando, FL, Oct. 2007, pp. 1–7.

[18]. C. Intanagonwiwat, R. Govindan, and D. Estrin (2005). "Directeddiffusion: A scalable and robust communication paradigm for sensor networks”, In Proceedings of the Sixth Annual International Conference on Mobile Computing and Networking, vol.2, pp. 56$ 67, 2005.

[19]. Elson, J. E., Girod, L., and Estrin, D.(2002). "Fine-Grained network time synchronization using reference broadcasts”, The Fifth Symposium on Operating Systems Design and Implementation (OSDI), pp. 147-163, 2002.

[20]. Cemua, A., jure, J., Hamilton, M. and Zhao, J. (2001). "Habitat monitoring: Application driver for wireless communications technology”, In Proceedings of the 2006 ACM SIGCOMM, vol.31, issue.2, pp.20-41, 2001.

[21]. Yao, K. , Hudson, R., Reed, C., Chen, D. and Lorenzelli, F. (1998). "Blind beam forming on a randomly distributed sensor array system”, IEEE Journal of Selected Areas in Communications, vol.16, no.8, pp.1555-1567, 1998.

[22]. Vig, J. (1992). "Introduction to Quartz Frequency Standards”, Technical Report SLCET-TR-92-1, Army Research Laboratory, Electronics and Power Sources Directorate, pp.8-43, 1992.

[23]. Kiyani, F., Razi, R., Talebzadeh, B. and Alizadeh, S. "Prolonging life time of wireless sensor network”, Second IEEE International Conference on Advanced Computer Control, vol. 2, pp. 8-11, 2010.

[24]. Maoti, M., Kusy, B., Simon, G. and ledeczi, A. (2004). "The fooding time synchronization protocol”, The Second International Conference on Embedded Networked Sensor Systems, pp.39-49, 2004.