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Enhanced Zigbee Tree Routing In Wireless Sensor Network

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Abstract: **Multipath routing is an efficient technique to route data in wireless sensor networks (WSNs) because it can provide reliability, security and load balance, which are particularly critical in the resource constrained system such as WSNs. The existing protocols are not fully satisfied. In this paper propose a new routing protocol that is enhanced zigbee tree routing (EZTR), to satisfy the QoS parameters. The new protocol provides less delay as compared with other protocol.**

Keywords: **wireless sensor networks (WSNs), quality of service (QoS).**

I. INTRODUCTION

Wireless sensor networks, an emerging technology are made up of sensor nodes which are distributed and autonomous in nature. These sensor nodes can vary in number from a few to thousands depending on the situation in which they are being used. These sensor networks are used in military, monitoring applications etc. they are also used in hostile environments such as disaster struck areas. Depending on the application or the area in which such a network is used the energy utilization of the individual nodes can vary.

Wireless Sensor Network (WSN) is usually deployed with a great number of sensor nodes to cover a large range of area to monitor events, collect data from environment, etc. The data collected by sensor nodes is usually transmitted to sink nodes, which are gateways to outside world, for further processing by a multi-hop network. Node failures and relocations should not hinder the successful transmission of data to the sinks. Consequently, WSN needs to be capable of adapting to changes in network topology caused by node failures, relocations and so on.

Initially, research interest is focused on single sink WSN. However, scalability of single sink WSN is not good enough to satisfy the demand of transmitting data from a large number of nodes to a single sink. As the number of nodes increases, network congestion due to hot spot phenomenon will be so severe that transmission cannot continue. Recently, interest is changed toward to multi-sink WSN. In a multi-sink WSN, the mean number of hops between nodes and sinks can be reduced remarkably; network congestion can be relieved by using appropriate routing method to balance traffic load among the sinks evenly. ZigBee is a specification of high level communication protocols built on top of IEEE 802.15.4 standard. Because of its low cost low power consumption properties and ability to support mesh network topology, zigbee is an ideal technology for implementation of WSN.

ZigBee is a wireless “standard” of ZigBee alliance based on IEEE 802.15.4 standard for Personal Area Networks. It defines the network and application layers on the top of physical and data link layers normalized in IEEE 802.15.4. ZigBee stack offers a wireless communication solution coupled with low cost, low energy consumption characteristics. It can be used in consumer electronics, industrial controls, PC peripherals, toys and games, etc. However, one of the potential applications of this standard is in Wireless Sensor Networks (WSN). In fact, IEEE 802.15.4 is designed to achieve a very low power consumption through several optimizations in Physical layer and Medium Access Control (MAC) sub-layer like the use of low duty cycles. The network layer uses a modified AODV (Ad Hoc on Demand Distance Vector) by default and Hierarchical Tree Routing (HTR) as last resort.

WSN have focused on Quality of Service (QoS) support to improve the reliability and performance under severe energy constraints. The improvement of QoS can be tackled in any layer. For instance several research work has been carried out on improving real time support in MAC sub-layer using GTS (Guaranteed Time Slot) mechanism of IEEE 802.15.4. This improves only real time QoS in single hop networks. In network layer, which provides end to end real time QoS in multi hop networks, this is done by adding and improving the QoS support to the routing algorithm.

II. BACKGROUND AND RELATED WORK

In 1981, Baker and Ephremides proposed a clustering algorithms called ―Linked cluster algorithm (LCA) for wireless networks. To enhance network manageability, channel efficiency and energy economy of MANETS, Clustering algorithms have been investigated in the past. Random competition based clustering (RCC)is applicable both to mobile ad hoc networks and WSN. RCC mainly focuses at cluster stability in order to support mobile nodes. The RCC algorithm applies the First Declaration Wins rule, in which any node can "govern" the rest of the nodes in its radio coverage if it is the first to claim being a CH. Some of well-known clustering algorithms for mobile ad hoc networks presented in the literature are Cluster Gateway Switch Routing Protocol (CGSR), Cluster-Based Routing Protocol (CBRP), Weighted Clustering Algorithm (WCA).

In recent years, insect sensory systems have been inspirational to new communications and computing models like bio inspired routing. It is due to their ability to support features like autonomous, and self-organized adaptive communication systems for pervasive environments like WSN and mobile ad hoc networks. Biological synchronization phenomena have great potential to enable distributed and scalable synchronization algorithms for WSN. An energy efficient and delay-aware routing algorithm is proposed based on ant-colony-based algorithms. Then a bio-inspired scalable network synchronization protocol for large scale sensor networks is proposed, which is inspired by the simple synchronization strategies in biological phenomena such as flashing fireflies and spiking of neurons. A biologically inspired distributed synchronization algorithm introduced is based on a mathematical model. It explains how neurons and fireflies spontaneously synchronize.The principles of genetics and evolution are adopted to enable service-oriented, autonomous, and self-adaptive communication systems for pervasive environments such as WSN and mobile ad hoc networks. An efficient bio-inspired communication paradigm for WSN is proposed based on the feedback loop mechanism developed by inspiration from the principles of cell biology.Then a clustering algorithm based on biological quorum sensing mechanism is mentioned. It helps the sensor nodes to form clusters according to spatial characteristics of the observed event signal.

QoS is the ability of a network element (e.g. an application, host or router) to have some level of assurance that its traffic and service requirements can be satisfied. QoS manages bandwidth according to application demands and network management settings. QoS has been extensively studied in wireless LANs and wired computer networks. IP and Asynchronous Transfer Mode (ATM) provide extensive QoS support ranging from best-effort service to guaranteed service.

In 2004, Al-Karaki and Kamal presented a detailed overview about the state of and the development trends in the field of QoS. It categorized routing into the following types of approaches: flat (all nodes play an equal role), hierarchical (some nodes are local cluster heads for example), position based (utilize location information), and power-aware (take battery usage and residual charge into consideration) QoS routing.

In general, routing in WSNs can be divided into flat-based routing, hierarchical-based routing, and location-based routing depending on the network structure. In flat-based routing, all nodes are typically assigned equal roles or functionality. In hierarchical-based routing, however, nodes will play different roles in the network. In location- based routing, sensor nodes' positions are exploited to route data in the network.

A routing protocol is considered adaptive if certain system parameters can be controlled in order to adapt to the current network conditions and available energy levels. Furthermore, these protocols can be classified into multipath-based, query-based, negotiation-based, QoS- based, or routing techniques depending on the protocol operation. In addition to the above, routing protocols can be classified into three categories, namely, proactive, reactive, and hybrid protocols depending on how the source sends a route to the destination. In proactive protocols, all routes are computed before they are really needed, while in reactive protocols, routes are computed on demand. Hybrid protocols use a combination of

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these two ideas. When sensor nodes are static, it is preferable to have table driven routing protocols rather than using reactive protocols. A significant amount of energy is used in route discovery and setup of reactive protocols. Another class of routing protocols is called the cooperative routing protocols. In cooperative routing, nodes send data to a central node where data can be aggregated and may be subject to further processing, hence reducing route cost in terms of energy usage..

III. PROTOCOL DESIGN

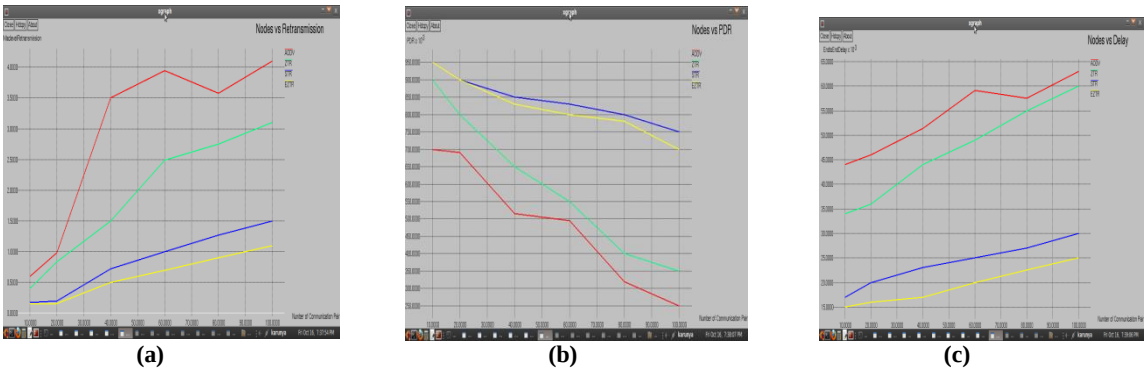
ZMR is a hybrid node disjoint multipath routing. When the source detects an event and in order to reduce the end-to-end latency, it starts immediately transmitting data packets to the Sink using the proactive hierarchical routing T R where the parent-child path is already established during the association phase at the MAC layer. Also, it starts the route discovery phase which represents the reactive part of ZMR. Unlike the traditional discovery phase with its heavy traffic of control messages (for instance RREQs), in our case, a light discovery phase is used in order to establish additional paths based on the parent-child and neighboring links and the ZigBee Tree Path information.

Given a source node S, the basic idea to build subsequent paths is as follow: Initialy, the source chooses as the next- hop node an adjacent neighbor from its neighbors table. If the neighbor is the Sink, noted by NS, or a node which belongs to a branch (subtree) not already used by TR(Tree Routing), noted by NTR(Neighbour Table Routing), then a new path of one link (in the case of NS neighbor) or composed of one neighbor link and the parent-child links from NTR to the Sink, can be directly used without triggering the discovery process.Otherwise, the source sends an Explore message ExploreMsg which is forwarded (unicast and never broadcast) from node to node using forwarding decisions. Whenever a node forwards the ExploreMsg, it records the next node and the node from which it has receveid the ExploreMsg in its routing table.When an intermediate node C at depth dc receives ExploreMsg, it starts searching for the next-hop node among node among its neighbors; otherwise, in its turn, it sends an ErrorMsg to its predecessor.This feedback mechanism continues until an intermediate node finds a good candidate node to forward the ExploreMsg or the ErrorMsg arrives at the source. In this case, if another candidate node is available and a new disjoint path is required, then the source can initiate a novel discovery process.

When the source node receives the ResponseMsg from its neighbor on which the discovery path was initiated, it means that another valid disjoint path is established and the source can use it for transmitting its data packets.Assume that the source has adjacent nodes(are not parent, child, Sink and NTR neighbors) and sends ExploreMsg in order to discover subsequent disjoint paths.

IV. PROTOCOL EVALUATION

We compare the performances of EZTR to those of STR, ZTR and AODV with various parameters. Two groups of simulation results are presented here. The first group is to compare the routing performances(with no of nodes) of ZTR,STR,AODV and EZTR under different mobility scenarios.The second group is to compare their performance under the communication pair. Perform five simulation runs for each configuration and record the Performasnce including packet retransmission, PDR, memory consumption, hop count and end-to-end delay. And found that EZTR performs better than STR,ZTR and AODV. The average performance of different runs is presented as follows.



(a) **(b)** **(c)**

Fig. Performance comparison (a) PDR(b) Packet Retransmission(c) End-To-End Delay

V. CONCLUSION

Proposed EZTR, a hybrid node disjoint multipath routing for ZigBee WSNs to handle high data rate applications. The proposed EZTR protocol combines the proactive and the reactive approaches in order to construct multiple node disjoint paths. For this aim, it exploits judiciously the address assignment scheme of ZigBee and the parent-child and non parent-child links. Firstly, The proactive part of the routing protocol is activated in order to reduce the end-to-end latency and to increase the network bandwidth, the reactive part of the protocol is triggered to discover other node disjoint paths. Extensive simulations have been carried out to evaluate the improved multipath routing from different aspects.

Results showed that the multipath routing EZTR provides the best performances in terms of packet delivery fraction, end to end delay, network lifetime, throughput and memory consumption with regard to the single path routing and satisfies soft QoS provision requirements of the high traffic applications.

In future work we introduce power nodes to increase the efficiency.

REFERENCES

[1] H. Lu, et al, "A Distributed and Efficient Flooding Scheme using 1-hop Information in Mobile Ad Hoc Networks," IEEE Transactions on Parallel and Distributed Systems, vol. 18, no. 5, pp. 658-671, 2007.

[2] D.B. Johnson and D.A. Maltz, "Dynamic Source Routing in Ad Hoc Wireless Networks," Mobile Computing, vol. 353, 1996, p. 153–181.

[3] Y. Huang, et al, "Distributed Throughput Optimization for ZigBee Cluster-Tree Networks," IEEE Transaction on Parallel and Distributed Systems, vol. 23, no. 3, pp. 513-520, 2012.

[4] Li, C. F., Ye, M., Chen, G., & Wu, J. (2005). An energy efficient unequal clustering mechanism for wireless sensor networks. In IEEE international conference on mobile ad-hoc and sensor systems (pp. 535–540).

[5] Bandyopadhyay, S., & Coyle, E. (2003). An energy-efficient hierarchical clustering algorithm for wireless sensor networks. In Proceedings of IEEE INFOCOM (Vol. 3, pp. 1713–1723).

[6] "S. Biswas and R. Morris, "ExOR: Opportunistic Multi-Hop Routing for Wireless Networks," in Proceedings of ACM Conference of the Special Interest Group on Data Communication (SIGCOMM), Philadelphia".

[7] "W. Heinzelman, A. Chandrakasan and H. Balakrishnan, "Energy-Efficient Communication Protocol for Wireless Mi- crosensor Networks," Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS '00), January 2000."

[8] Yuan Ping and B. Y. Wang Hao, "A Multipath Energy-Efficient Routing Protocol for Ad hoc Networks," Communications, Circuits and Systems Proceedings, 2006 International Conference on, Vol. 3, pp. 1462-1466, Guilin, January 2007.

[9] O. Younis and S. Fahmy, "HEED: A Hybrid, Energy-Efficient, Distributed Clustering Approach for Ad Hoc Sensor Networks," IEEE Trans. Mobile Computing, Vol. 3, No. 4, pp. 366-379, Oct.-Dec. 2004.

[10] S.D. Muruganathan and A.OFapojuwo, "A Hybrid Routing Protocol for Wireless Sensor Networks Based on a Two-Level Clustering Hierarchy with Enhanced Energy Efficiency," Wireless Communications and Networking Conference, 2008, pp. 2051- 2056, Las Vegas, NV, April 2008.