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Shortcut Path Tress for Zigbee based Wireless Network

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Abstract-
Neighbour Table based shortcut tree routing protocol provides the near optimal routing path as well as maintains the advantages of the ZigBee tree routing such as no route discovery overhead and low memory consumption. However, in Neighbour table based Shortcut tree routing the limitation is that route discovery is only on basis of Distance between Nodes; thus, it cannot provide optimized paths. Here, the concept of link quality factor between nodes along with the distance between two nodes to calculate the shortest path between source and destination. Where the Link quality will depend upon traffic between two nodes, higher the traffic lesser the link quality and vice versa. Score will be calculated for links which is function of Distance and Link Quality between nodes i.e score= $f(d,l_q)$, this is the idea proposed in OPTIMIZING ROUTING PATHS UING SHORTCUT TREES FOR ZIGBEE BASED WIRELESS NETWORK.

I. Introduction

ZigBee is a worldwide standard of wireless personal area network targeted to low-power, cost-effective, reliable, and scalable products and applications. Different from the other personal area network standards such as Bluetooth, UWB, and Wireless USB, ZigBee provides the low power wireless mesh networking and supports up to thousands of devices in a network. Based on these characteristics, ZigBee Alliance has extended the applications to the diverse areas such as smart home, building automation , health care , smart energy , telecommunication, and retail services.

The ZigBee network layer, which is the core of the standard, provides dynamic network formation, addressing, routing, and network management functions. ZigBee supports up to 64,000 devices in a network with the multihop tree and mesh topologies as well as star topology. Every node is assigned a unique 16-bit short address dynamically using either distributed addressing or stochastic addressing scheme. The routing protocols of ZigBee are diverse so that a system or users can choose the optimal

II. Literature Survey

Taehong Kim, SeongHoon Kim, Jinyoung Yang, Seong-, Daeyoung Kim, "Neighbor Table Based Shortcut Tree Routingin ZigBee Wireless Networks", IEEE TRANSACTIONS ON PARALLEL AND DISTRIBUTED SYSTEMS, VOL. 25, NO. 3, MARCH 2014.

The ZigBee tree routing is widely used in many resource-limited devices and applications, since it does not require any routing table and route discovery overhead to send a packet to the destination. However, the ZigBee tree routing has the fundamental limitation that a packet follows the tree topology; thus, it cannot provide the optimal routing path.

In this paper, we propose the shortcut tree routing (STR) protocol that provides the near optimal routing path as well as maintains the advantages of the ZigBee tree routing such as no route discovery overhead and low memory consumption. The main idea of the shortcut tree routing is to calculate remaining hops from an arbitrary source to the destination using the hierarchical addressing scheme in ZigBee, and each source or intermediate node forwards a packet to the neighbor node with the smallest remaining hops in its neighbor table.

Inference drawn: 1-hop neighbor information improves overall network performances by providing an efficient routing path. shortcut tree routing achieves the comparable performance to AODV with limited overhead of neighbor table maintenance as well as overwhelms the ZigBee tree routing.

Our objective is to provide the near optimal routing path like the reactive routing protocol as well as to maintain the advantages of ZTR such as no route discovery overhead and little memory consumption for the routing table.

Inference drawn: The main idea of STR is that we can compute the remaining tree hops from an arbitrary source to a destination using ZigBee address hierarchy and tree structure.

M. Al-Harbawi, M.F.A. Rashid, N.K. Noordin, "Improved Tree Routing (ImpTR) Protocol for ZigBee Network", IJCSNS International Journal of Computer Science and Network Security, VOL.9 No.10, October 2009.

Many application scenarios in wireless sensor network (WSN) require connectivity between nodes to transmit the collected data to a sink node. ZigBee

is a standard for wireless personal area network (WPAN) based on IEEE 802.15.4. It has been developed for low cost, low data rate and low power consumption. ZigBee uses Ad-Hoc On-demand Distance Vector (AODV) and Tree Routing (TR) as a routing protocol. In TR protocol, the packets follow the tree topology for forwarding the data to the sink node even if the sink node is located near to the source node. In this paper, we present an enhancement of the TR protocol called Improved Tree Routing (ImpTR) protocol. The new ImpTR protocol determines the shortest path to the sink node depending on the neighbor table instead of following the tree topology. The packets are forwarded to the neighbor node if the path to the destination through neighbor node is shorter than the path through PAN coordinator.

Inference drawn: Improved Tree Routing (ImpTR) protocol algorithm provides shorter average end-to-end delay, increase throughput and decrease the energy consumption from the network when compared to the original TR routing protocol.

III. Problem Statement

- If one node has two neighbouring nodes, one is located at say 1metres away and second one is 2 metres away from that node. But traffic at 1 metre away node is more than the traffic at 2 metre away node.
- But traffic will be send to one metre away node only as it is nearer to the node which has to send the traffic.
- Delay in routing

IV. The Proposed Mechanism

ZIGBEE TREE ROUTING

ZTR is designed for resource constrained ZigBee devices to choose multihop routing path without any route discovery procedure, and it works based on hierarchical block addressing scheme described in (1) and (2).

Fig. 1 shows an example of the ZigBee address assign-
ment scheme and the address hierarchy when Cm (nwkMaxChildren), Rm (nwkMaxRouters), and Lm (nwkMaxDepth) are given with 3, 2, and 3 respectively. Cm, Rm,and Lm are defined as the maximum number of children aparent may have, the maximum number of routers a parentmay have as children, and the maximum tree level of anetwork in ZigBee standard, respectively,

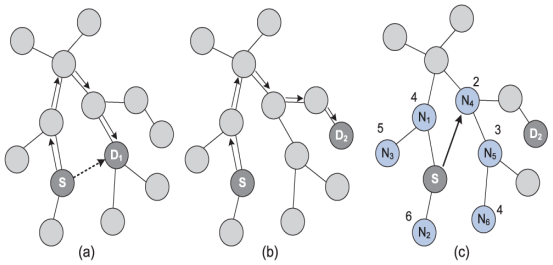

Fig. 1. ZigBee tree routing and shortcut tree routing.

SHORTCUT TREE ROUTING

We propose the STR algorithm that solves these twoproblems of the ZTR by using 1-hop neighbor information. The STR algorithm basically follows ZTR, but chooses one of neighbor nodes as the next hop node when the remaining tree hops to the destination can be reduced. For example, in Fig. 2c, STR computes the remaining tree hops from the next hop node to the destination for all the neighbor nodes, and selects the N4 as the next hop node to transmit a packet to the destination D2 .

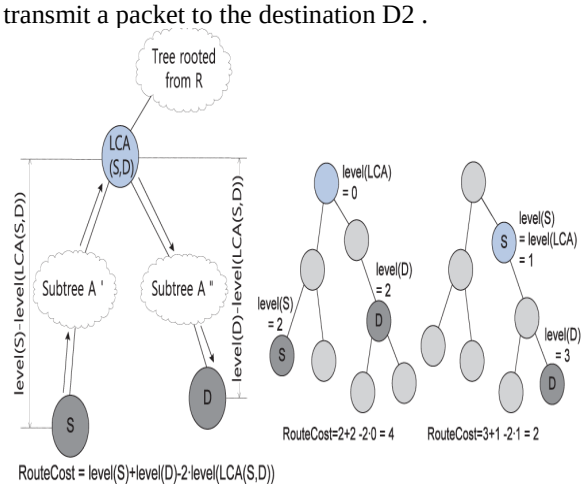

Fig. 2.Calculation of ZigBee tree routing cost between a source and a destination.

V. Design and ImplementationSoftware environment

NS 2 (Network Stimulator-2) is Object-oriented, discrete event-driven simulator. Written in C++ and Otcl.NS2 programs written in object Tcl programming.

Hardware requirement

Zigbee modules can be used for creating the WPAN. But is too costly.

VI. Conclusion:

In this paper, we have identified the detour path problemand traffic concentration problem of the ZTR. These are thefundamental problems of the general tree routing protocols,which cause the overall network performance degradationTo

overcome these problems, we propose STR that uses theneighbor table, originally defined in the ZigBee standard. InSTR, each node can find the optimal next hop node basedon the remaining tree hops to the destination. Themathematical analyses prove that the 1-hop neighbour information in STR reduces the traffic load concentratedon the tree links as well as provides an efficient routingpath. The network simulations show that STR provides thecomparable routing performance to AODV as well asscalability respect to the network density and the networktraffic volume by suppressing the additional route discovery process. Therefore, as discussed in Section 4 in theonline supplemental material, we expect STR to be utilizedin many ZigBee applications requiring both small memorycapacity and high routing performances.

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