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OPTIMIZATION OF ROUTING PATH IN ZIGBEE NETWORKS USING SHORTCUT TREE ROUTING AND EFFICIENT TRANSMISSION WITH WATCHDOG METHOD

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ABSTRACT

The dynamic nature of the major challenge to design and deployment of Mobile ad hoc networks (MANETs).In this paper, the optimization of routing is done by the shortcut tree routing and we compare the behavior of three routing protocols AODV, ZTR, STR, with the consideration of the node misbehavior. MANETs are composed of mobile nodes. The nodes can freely move around while communicating each other. The nodes participating in the packet forwarding should co-operate if these nodes are not forwarding the packets to the destination then that nodes are called selfish nodes.This selfish node detection is the important factor in the network performance. This problem of node misbehavior detected and controlled by different techniques. Here, we use the watchdogs method which is efficient than other general techniques. Watchdogs are the way to detect the selfish nodes in computer networks.

Keywords: Shortcut tree routing, Neighbor table, Optimal routing path, Selfish nodes, Watchdog method.

I. INTRODUCTION

A group of wireless nodes communicating in a localized wireless environment in the absence of any centralized administration and any fixed infrastructure, is known as a mobile ad hoc network (MANET) [1]. The routing protocols implemented in MANETs are globally classified into two categories: proactive or table driven protocols and reactive or on-demand protocols. Table driven protocols rely on a table, which maintains consistent up-to-date information concerning routes to all possible destinations, whereas on-demand routing protocols implement source-initiated route organization, where a route is created when desired by the node. In this paper, we compare the performance of different routing protocols, ZTR, STR, AODV.

Zigbee is a specification for a suite of high level communication protocols used to create personal area networks built from small, low power digital radios [2]. Zigbee based on IEEE 802.15.4 standard, though its low power consumption limits transmission distances to 10-100 meters line-of-sight, depending on power output and environmental characteristics, Zigbee devices can transmit data over

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long distances by passing data through a mesh network of intermediate devices to reach more distant ones.

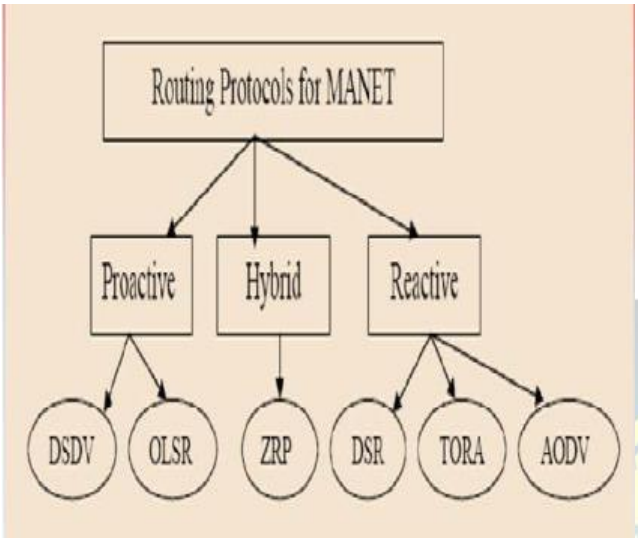

Figure 1 Routing Protocols For MANET

The Zigbee network layer natively supports both star and tree networks, and generic mesh networking. The Zigbee network layer, which is the core of the standard, provides dynamic network formation, addressing, routing, and network management functions [2]. Zigbee supports up to 64,000 devices in a network with the multi- hop tree and mesh topologies as well as star topology. Zigbee device has three components. They are Zigbee coordinator, Zigbee router and Zigbee end device. Zigbee coordinator forms the root of the network tree and might bridge to other networks. Zigbee router can act as an intermediate router, passing on data from other devices.

Zigbee End Device (ZED) Contains just enough function to talk to the parent node it cannot relay data from other devices. Zigbee device is shown in figure 1.

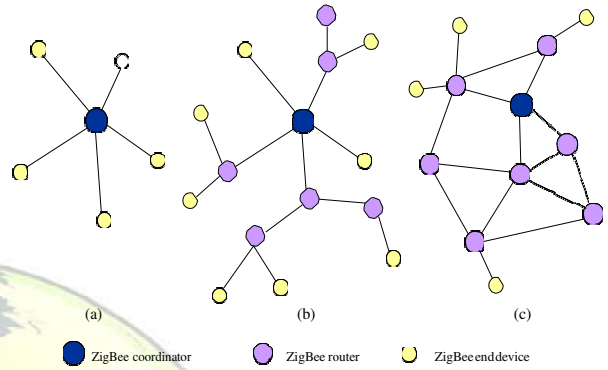

Figure 2 Zigbee Device

Shortcut tree routing (STR) protocol enhances the path efficiency of ZTR by adding the 1-hop neighbor information [4]. Where ZTR only uses tree links like connecting the parent nodes and child nodes, STR provides the neighbor nodes by short cutting the tree routing paths in the mesh topology.

In STR a source nodes or an intermediate nodes select the next hop node having the smallest remaining tree hops to the destination. Whether it is a parent node, one of children node, or neighboring node.

The STR algorithm that solves these two problems of the ZTR by using 1-hop neighbors information [5]. STR algorithm follows ZTR to chooses one of neighbor nodes as the next hop node when the remaining tree hops to the destination can be reduced.

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

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node to transmit a packet to the destination D2 (in figure 3).

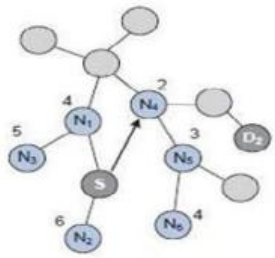

Figure 3 Shortcut Tree Routing

Christo Ananth et al. [3] discussed about an eye blinking sensor. Nowadays heart attack patients are increasing day by day."Though it is tough to save the heart attack patients, we can increase the statistics of saving the life of patients & the life of others whom they are responsible for. The main design of this project is to track the heart attack of patients who are suffering from any attacks during driving and send them a medical need & thereby to stop the vehicle to ensure that the persons along them are safe from accident. Here, an eye blinking sensor is used to sense the blinking of the eye. spO2 sensor checks the pulse rate of the patient. Both are connected to micro controller.If eye blinking gets stopped then the signal is sent to the controller to make an alarm through the buffer. If spO2 sensor senses a variation in pulse or low oxygen content in blood, it may results in heart failure and therefore the controller stops the motor of the vehicle. Then Tarang F4 transmitter is used to send the vehicle number & the mobile number of the patient to a nearest medical station within 25 km for medical aid. The pulse rate monitored via LCD .

There are three types of control messages in AODV which are discussed below.

Source node that needs to communicate with another node in the network transmits RREQ message. AODV floods RREQ message, using expanding ring technique. There is a time to live (TTL) value in every RREQ message, the value of TTL states the number of hops the RREQ should be transmitted.

Route Reply Message (RREP):

A node having a requested identity or any intermediate node that has a route to the requested node generates a route reply RREP message back to the originator node.

Route Error Message (RERR):

Every node in the network keeps monitoring the link status to its neighboring nodes during active routes. When the node detects a link crack in an active route, (RERR) message is generated by the node in order to notify other nodes that the link is down.

II. WATCHDOG METHOD

Identification of misbehaving nodes in ad hoc networks is critically important to detect security attack in the network. Two types of misbehaving nodes such as selfish and malicious nodes[8] , Selfish nodes do not intend to directly damage other nodes, but however, do not cooperate, saving battery life for their own communications. But malicious nodes do not give priority to saving battery life, and aim at damaging other, It disables the packet forwarding mechanism for the packets which have a destination address, other than this selfish node. In fact, it helps the selfish node to save its own energy, thereby still contributing to network maintenance.

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To detect the selfish nodes watchdog method is introduced, that allows detecting misbehaving nodes[7]. When a node forwards a packet, the watchdog set in the node ensures that the next node in the path also forwards the packet. The watchdog does this by listening to all nodes within transmission range promiscuously. If the next node does not forward the packet then it is tagged as misbehaved. Due to the effectiveness of the watchdog and its relative easy implementation, several proposals use it as the basis of their IDS solutions.

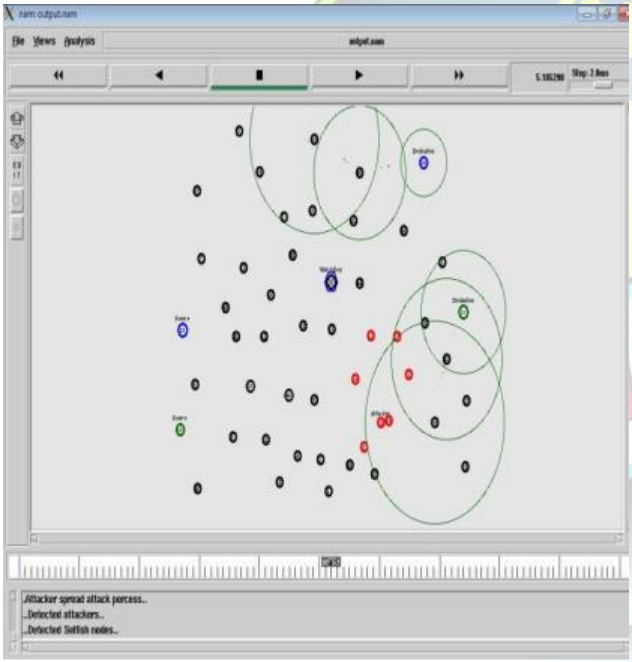

Figure 4 Routing in Network Simulator

The network animator of the network simulator is shown here, the misbehavior of the selfish nodes detected and the watchdog recorrect the transmission. The selfish nodes enter into the transmission area at such time interval, the watchdog found out these nodes and change the transmission path to avoid the packet loss by this nodes[10].

In this way the other nodes protected from misbehaving as a selfish node. Because of the watchdog method the transmission is efficiently carried out.

III. MATERIALS AND METHODS

The simulation is carried out with the help of NS-2 software using Object oriented tool command language(OTCL).NS2 is an object oriented simulator, written in C++, with a Tcl interpreter as a front-end. The simulator supports a class hierarchy in C++ (also called the compiled hierarchy), and a similar class hierarchy within the Tcl interpreter (also called the interpreted hierarchy).

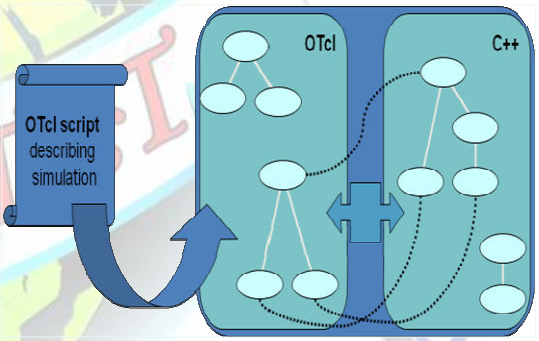

Figure 5 NS2 Internal Schematic Diagram

The two hierarchies are closely related to each other; from the user's perspective, there is a one-to-one correspondence between a class in the interpreted hierarchy and one in the compiled hierarchy.

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IV. SIMULATION RESULTS

The following simulation results show the effectiveness of the proposed method. The outputs shows the comparison of different properties of the transmission over the three protocols AODV, ZTR, STR and STR with Watchdog method.

Figure 6 Hop Count

The Figure 6 shows the Hop count for the transmission. The hop count is the number of network devices between the starting node and the destination node. Here we compare the hop count and the STR with watchdog provides minimum of hop count. AODV protocol uses maximum number of hops.

The Figure 7 shows the memory consumption for routing.The memory consumption is memory taken for the transmission of packet from node to node and here the STR with Watchdog method provides lowest memory consumption.

The other methods having comparatively high memory consumption than this one.

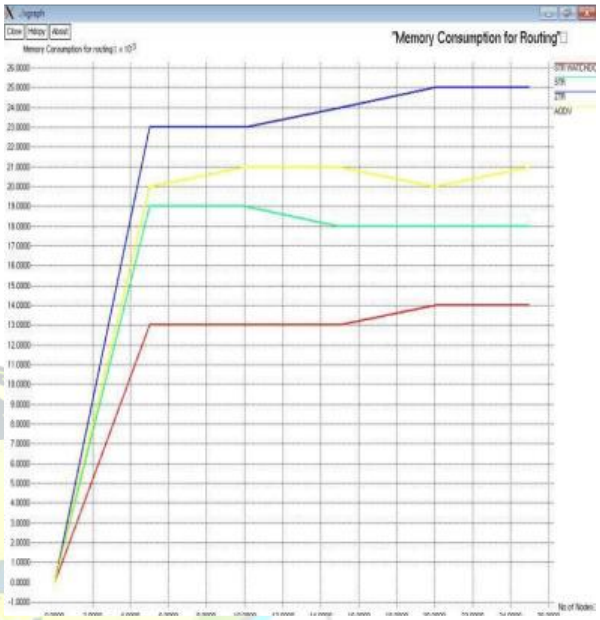

Figure 7 Memory Consumption For Routing

The Figure 8 shows the Packet Delivery Ratio. The maximum packet delivery provides the efficient transmission and the STR with watchdog method deliver maximum number of packets than other protocols.

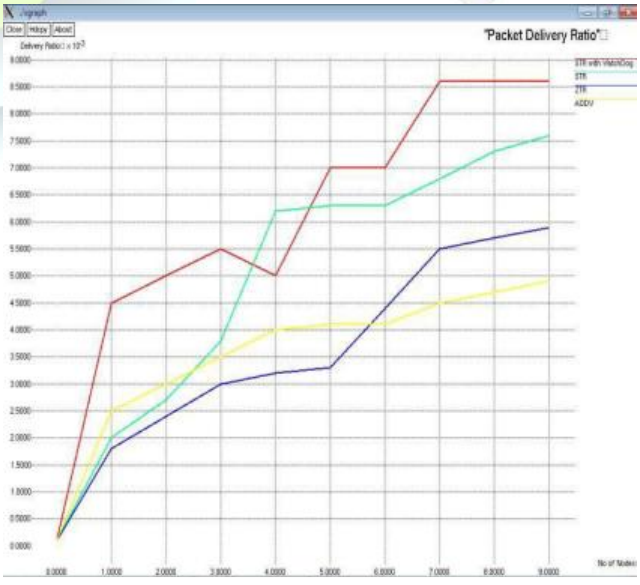

Figure 8 Packet Delivery Ratio

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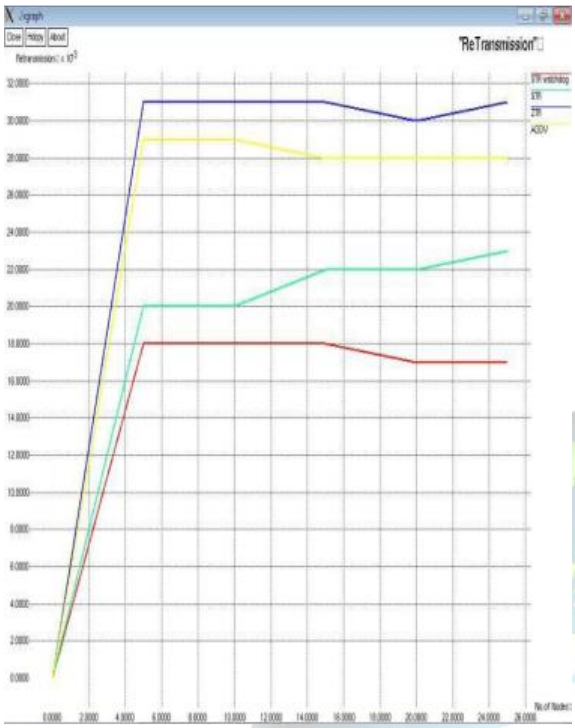

Figure 9 Retransmission

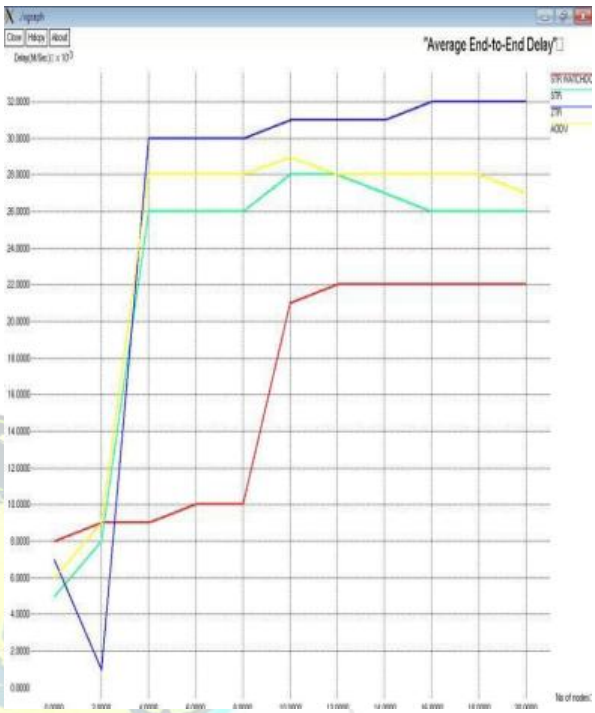

Figure 11 Average End-to-End Delay

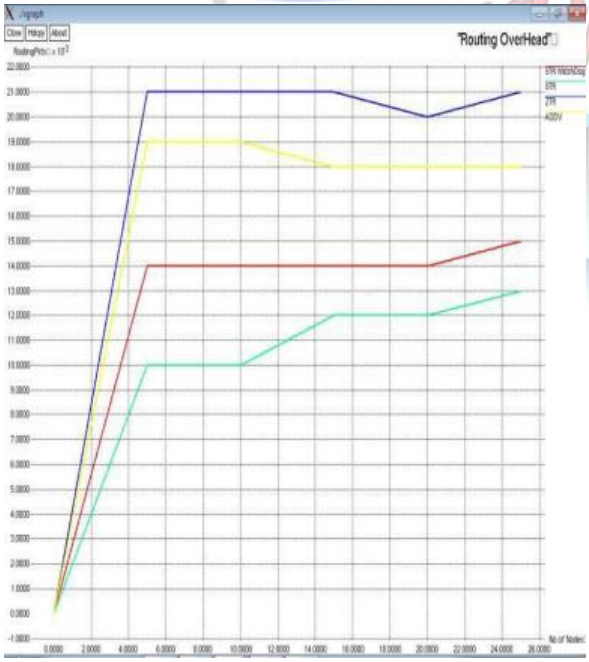

Figure 10 Routing Overhead

The figure 9 shows the retransmission. If the packets are not sent to the destination then that packets are known as lossed packets, these packets are retransmit to the node. In STR with watchdog the packet loss is low so the retransmission is less.

The routing overhead and average end to end delay also less in the watchdog method when compared with ZTR and AODV. The comparison of all protocols mentioned here, overall performance of STR with Watchdog method is the good one. Thus it provide efficient transmission.

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V. CONCLUSION

ZigBee tree routing (ZTR) prevents the route discovery overhead in both memory and bandwidth using the distributed block addressing scheme.STR protocol provides the optimal routing path using the 1 hop neighbor information and its packet delivery ratio is improved. In this paper, the optimization of routing is done by shortcut tree routing and the misbehavior of the nodes can be identified using the Watchdog method and the other nodes are protected from changing as a selfish nodes using this method. The STR with Watchdog method provides the efficient transmission of packets from node to node by detecting the selfish nodes in the transmission, minimize the packet loss ,and retransmit the packets which are not delivered to the next node in the transmission. Thus the STR with Watchdog method is the optimal protocol for the routing when compared with the other protocols like AODV,ZTR,STR.

In future We are also continuing to study other routing protocols for use in ad hoc networks, including those based on distance vector or link state routing, as well as the interconnection of an ad hoc network with a wide-area network such as the Internet, reachable by some but not all of the ad hoc network nodes. We are currently examining these issues with respect to attacks on privacy and denial of service in the routing protocol. Finally, we are beginning implementation of the protocol on notebook computers for use by students in an academic environment.

REFERENCES

[1] B.-R. Chen, K.-K. Muniswamy-Reddy, and M. Welsh, "Ad-Hoc Multicast Routing on Resource-Limited Sensor Nodes," Proc.Second Int'l Workshop Multi-Hop Ad Hoc Networks from Theory to Reality, 2006.

[2] S. Chen et al., "A Reliable Transmission Protocol for ZigBee-Based Wireless Patient Monitoring," IEEE Trans. Information Technologyin Biomedicine, vol. 16, no. 1, pp. 6-16, Nov. 2012.

[3] Christo Ananth, S.Shafiqa Shalaysha, M.Vaishnavi, J.Sasi Rabiyathul Sabena, A.P.L.Sangeetha, M.Santhi, "Realtime Monitoring Of Cardiac Patients At Distance Using Tarang Communication", International Journal of Innovative Research in Engineering & Science (IJIRES), Volume 9, Issue 3,September 2014,pp-15-20

[4] T. Kim, D. Kim, N. Park, S. Yoo, and T.S. Lopez, "Shortcut Tree Routing in ZigBee Networks," Proc. Int'l Symp. Wireless Pervasive Computing (ISWPC), 2007.

[5] S. Chen et al., "A Reliable Transmission Protocol for ZigBee-Based Wireless Patient Monitoring," IEEE Trans. Information Technology in Biomedicine, vol. 16, no. 1, pp. 6-16, Nov. 2012.

[6] I.Chakeres, "AODVjr, AODV Simplified," ACM SIGMOBILE Mobile Computing and Comm. Rev., vol. 6, pp. 100-101, 2002.

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Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
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[7] D DJENOURI, Nadjib BADACHE,"A Gradual Solution to Detect Selfish Nodes in Mobile Ad hoc Networks,"Proc.14 th European Conf.Research in computer networks, pp.355-370, 2009.

[8] H. Yang, H. Y. Luo, F. Ye, S. W. Lu, and L. Zhang, "Security in mobile ad hoc networks: Challenges and solutions," IEEE Wireless Communications, vol. 11, pp. 38–47, 2004.

[9] D. Han and J. Lim, "Smart Home Energy Management System Using IEEE 802.15.4 and ZigBee," IEEE Trans. Consumer Electronics, vol. 56, no. 3, pp. 1403-1410, Oct. 2010.

[10]Agbaria et al., "Efficient and Reliable Dissemination in Mobile Ad Hoc Networks by Location Extrapolation," J. Computer Networks and Comm., 2011.