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Performance Comparison of Various Routing Protocols for Wireless Network Sensors

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Abstract:*A wireless adhoc network sensor system contains very small stations known as nodes. These nodes communicate with each other using various routing protocols in wireless fashion. The routing protocols are classified as Proactive and Reactive based on their update mechanism. This paper mainly compares the different routing protocols such as; AODV, OLSR,DSR and DSDV. The performance of these protocols are examined in terms of throughput, end to end delay, and nodes life. The simulation for the current work is completed using network simulator 2.*

Keywords: *Wireless sensor network, DSDV, AODV, OLSR, DSR.*

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I. INTRODUCTION

Wireless sensor network (WSN) comprises of various sensor nodes are deployed on large geographic area. These sensor nodes forward the sensed information toward a base station for further processing with respect to control, meeting objectives of the system. The base station is located either inside or outside the sensor field depends upon type of application [1]. Moreover, on basis of application type and requirement, the base station can be static or mobile. In general, the sensor nodes in WSN are inexpensive and disposable and can be handled easily. But, the increase in computing devices now a days, increases the computing capacity and complexity of the wireless network. Because of this rising complexity, the management of communication protocols and network management issues are reaching to the next level of human ability and putting the stability of existing infrastructure, systems and data at higher risk. Therefore, the security mechanism for the sensor network must be energy efficient, adaptive, robust, and scalable with fully distributed and self-organizing architectures. Moreover, a considerable amount of energy can be saved if routing is planned sensitively and it is very important to know the basic demand of application to select, implement and simulate the routing protocol for application.

Various routing protocols with unique features have been developed for wireless sensor network. Therefore, selection of accurate routing protocol is very difficult for the application demand. Many researchers have been working in this direction to evaluate the performance of these protocols in different simulation environments. [1], describes the novel energy efficient routing protocol for wireless sensor networks and proposed a hierarchical cluster based protocol which is reliable in terms of data delivery at base station. Generally, the routing protocols are classified as Reactive, Proactive and Hybrid. Many routing algorithms have been proposed for these routing protocols [2]. The Reactive protocol use ondemand routing algorithm such as; Adhoc Ondemand Distance Vector (AODV) or Weight Based Adhoc Ondemand Distance Vector (WBAODV), to transfer the data to adhoc network. The ondemand algorithm establishes a unicast or multicast route only for the demand by the source. It is also a loop-free and self-starting system which use sequence numbers to ensure the freshness of route. For establishing a route between source and demand, it broadcasts a Route Request (RREQ) packet containing source node's IP address, current sequence number, broadcast ID and updated sequence number for the destination. On receiving the RREQ, node receive the packet, update their information and set up backwards pointers through unicast to the source node in the route tables or rebroadcasts the RREQ. RREP propagates back to the source and finally source establish the route and start transmitting data packets. The route remains active only for the duration for which the data is being transmitted thereafter nodes propagates the error message (RERR).

The proactive protocol uses a table driven routing approach such as; Destination Sequenced Distance Vector (DSDV), Routing Approach (DSDV) for adhoc mobile networks. This approach was designed by C. Perkins and P. Bhagwat using Bellman–Ford algorithm with a purpose to solve the routing loop problems. This approach continuously evaluates the path of the network, and transmit the data packets at requirement. Therefore, the route determination required more time as compared to reactive protocol which is not applicable to the real time system due to large traffic. Moreover, sequence numbers such as even and odd numbers, generated by destination decides the link activation in proactive approach.

The hybrid routing protocol uses both proactive and reactive approaches in combination to establish a route. Generally, proactive approach is used in its internal zone to evaluate the early routes and reactive approach in its intra-zone, which communicates between inter-zone of the network [3]. It also compares the performance of AODV, DSDV and ZRP (Zone Routing Protocol) either by keeping no. of CBRs constant and varying nodes or vice versa.Mohapatra et. al. analyzed the AODV, DSR, OLSR and DSDV using NS2 simulator in terms of delay, throughput, packet delivery ratio, and control overhead [4]. Zhu et. al. proposed Energy-Efficient Routing Algorithm to Prolong Lifetime (ERAPL), which increases network lifetime and extends energy efficiency [5]. Filipo analyzed and compared the prominent routing schemes and presented a view to understand short range wireless network solutions [6]. Moreover, the behavior of OLSR and DSR routing protocols using random way point model and OPNET 16.0 Simulation tool is examined in [7-9]. Siddiqui et. al., evaluated examined LEACH protocol to analyses its energy consumption with respect to various traffic loads, node densities and sizes of wireless network. It is found that LEACH protocol consumes considerable amount of energy even no transmission of data is there [10]. John et. al. proposed S-MAC, a Medium-Access Control (MAC) protocol comprises of three traditional approaches to minimize energy consumption and proved that 802.11 MAC consumes 2–6 times more energy than SMAC for traffic load with messages sent every 1–10s [11]. Bhuyian, discussed performance of AODV, AOMDV, DSR, DSDV and different connections like; TCP, Constant Bit Rate (CBR) for wireless networks by varying pause and speed time in network simulator NS2.35 [12]. Also, the paper proposed an Energy Balanced Routing Protocol (EBRP) and shown improvements in energy balance, network lifetime, coverage ratio, and throughput in comparison with traditional routing algorithm. Salva et. al. simulated a complete underwater WSN ecosystem in NS-3 simulator [13]. Mann & Singh, evaluated that Bee Swarm, performs better in terms of packet delivery and energy consumption compared to other hierarchical routing protocols for wireless network [14]. But after the lots of developments, increasing energy efficiency and network lifetime is the biggest challenge of mobile adhoc network and wireless sensor network.Therefore, the energy efficient protocol is still in demand to meet the requirement of current complex traffic.

II. EXPERIMENTAL WORK

The current research work proposed a hybrid approach consisting of WBAODV and DSDV protocol with an objective to decrease the transmission delay, reduce energy consumption of network, increase throughput and incresae packet delivery fraction. The algorithm for the proposed hybrid scheme is presented in Figure 1.

III. SIMULATING RESULTS

The analysis and comparison of protocols can be evaluated by real world experiments or simulation. Since simulation is cheaper or flexible more research work of wireless sensor networks is conducted using simulation software. It reduces the need for time consuming and costly real world experiments. The simulation used in my analysis is Network Simulator 2.34. The reason for choosing this software is live visualizer, connected to real world, portability. Each simulation was carried out for 500 seconds. The parameter of simulation environment is given in Table 1. The comparative performance of the routing protocols is shown in Table 2.

3.1. End to End Delay

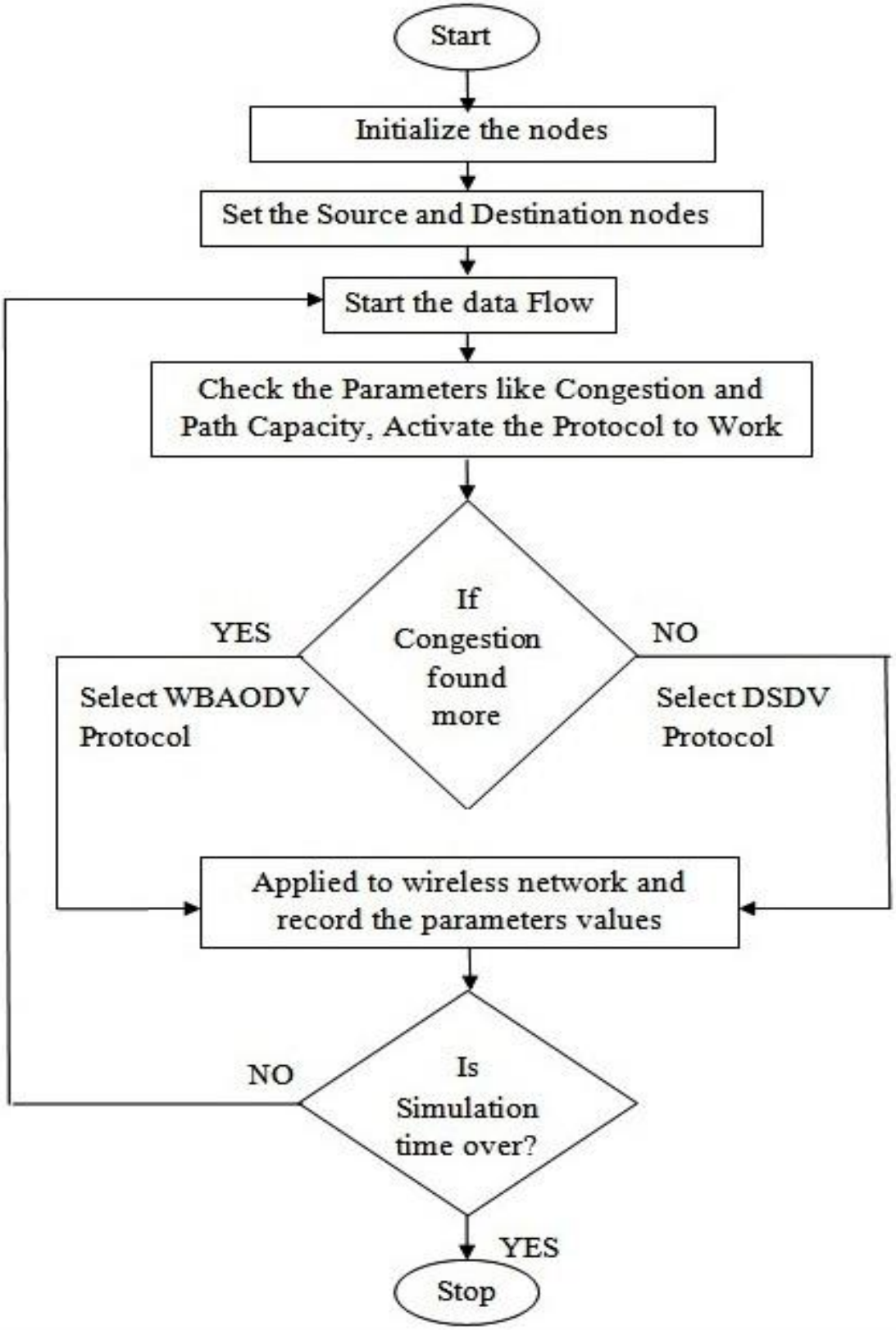
The end to end delay is the delay in time due to route discovery, route setup, and queue of data packets, to reach data packets at the destination. It is also known as the difference between arriving (T_r) and sending time (T_s). The measurement of end to end delay for the proposed hybrid protocol w.r.t pause time is plotted in simulator and shown in figure 2 in comparison with WBAODV, and DSDV. In general, the end to end delay should be minimum and as expected, the hybrid approach shows a considerable improvement in delay.

3.2. Throughput

It is the amount of data transmitted in unit time from one node to another in wireless adhoc network. Figure 3 shows the measured thoughput of hybrid protocol w.r.t pause time. For a efficient protocol and better network

perfomance, throughput must be maximum. It is seen that the thoughput of the proposed scheme is much higher than that of WBAODV and DSDV.

Figure 1. Hybrid routing protocol mechanism flowchart



3.3. Packet Delivery Fraction (PDF)

Packet Delivery Fraction is known as percentage of packets delivered to the destination. Greater the value of PDF, the better performance of the network there is. The figure 4 indicates the packet delivery fraction of the hybrid scheme and it is found that using a mixture of reactive and proactive protocols the PDF is increased significantly.

3.4. Energy Consumption

A great amount of energy is consumed while sending a file or data from source to destination and the batteries which are supplying energy to the complex sensor in a hostile network lose their strength before its age. In real environment, replacement of batteries is very costly and affects the overall cost of the network. Therefore, it is highly demanded to minimize energy consumption. The figure 5 compares the energy consumed by the proposed hybrid protocol and traditional AODV, WBAODV, DSDV. It is seen that hybrid approach consumes very less amount of energy in data transmitting as compared to AODV, WBAODV, DSDV.

Table: 1 Simulation Parameters of different Protocol

Simulator	Network Simulator 2.34
Network Size	1000m x 1000m
No. of nodes	50
Simulation Time	50Sec
MAC Type	802.11
Bandwidth	4Mz
Traffic Sources	CBR, FTP
Traffic Agents	UDP, TCP
Interface Queue Length	50
Packet Size	512 Byte data
Max speed	10
Interval time b/w Packets	0.05
Max. Packets to be send	10000

Table:2 Comparative results of AODV, WBAODV, DSDV, Hybrid Protocol

Protocol / Parameters	AODV	WBAODV	DSDV	HYBRID
End to End Delay	20.91	18.86	11.94	13.20
Throughput	187.22	244.41	220.88	393.49
PDF	0.049	0.099	0.075	0.319
Energy	6.074	3.115	4.108	1.000096

Figure 2: Comparative analysis of End to End Delay**Figure 3:** Comparative analysis of Throughput

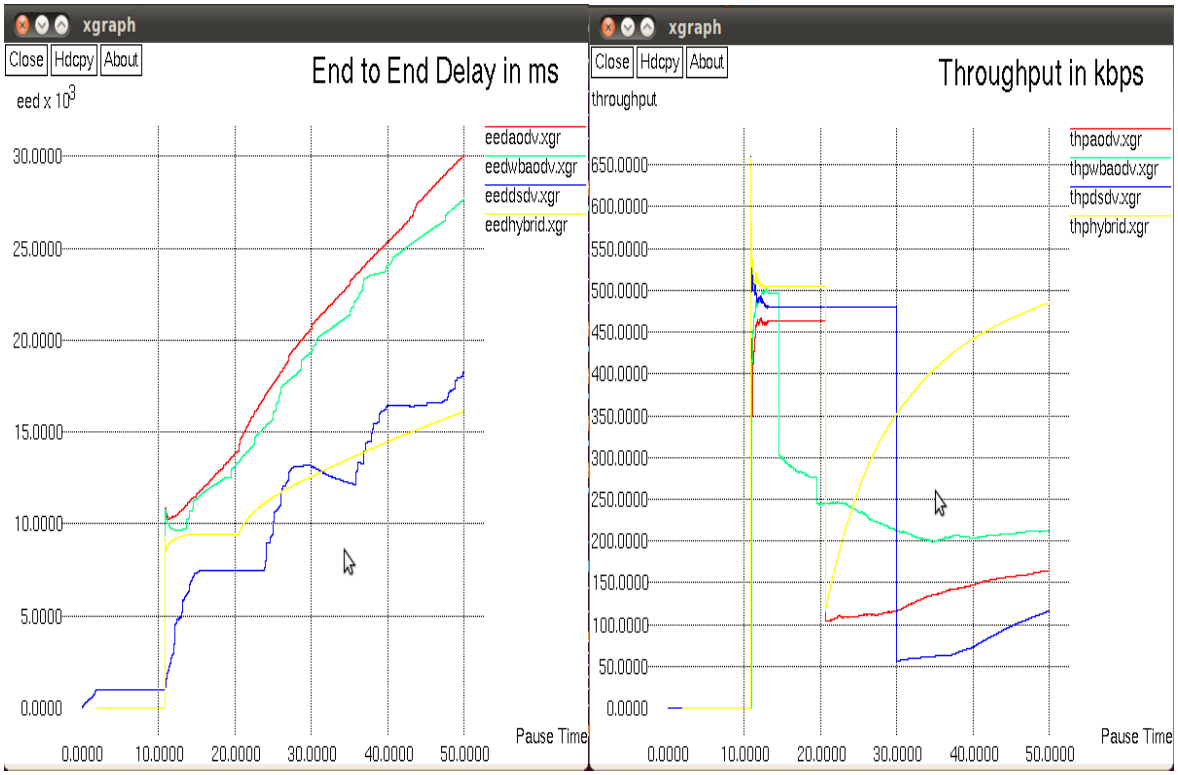
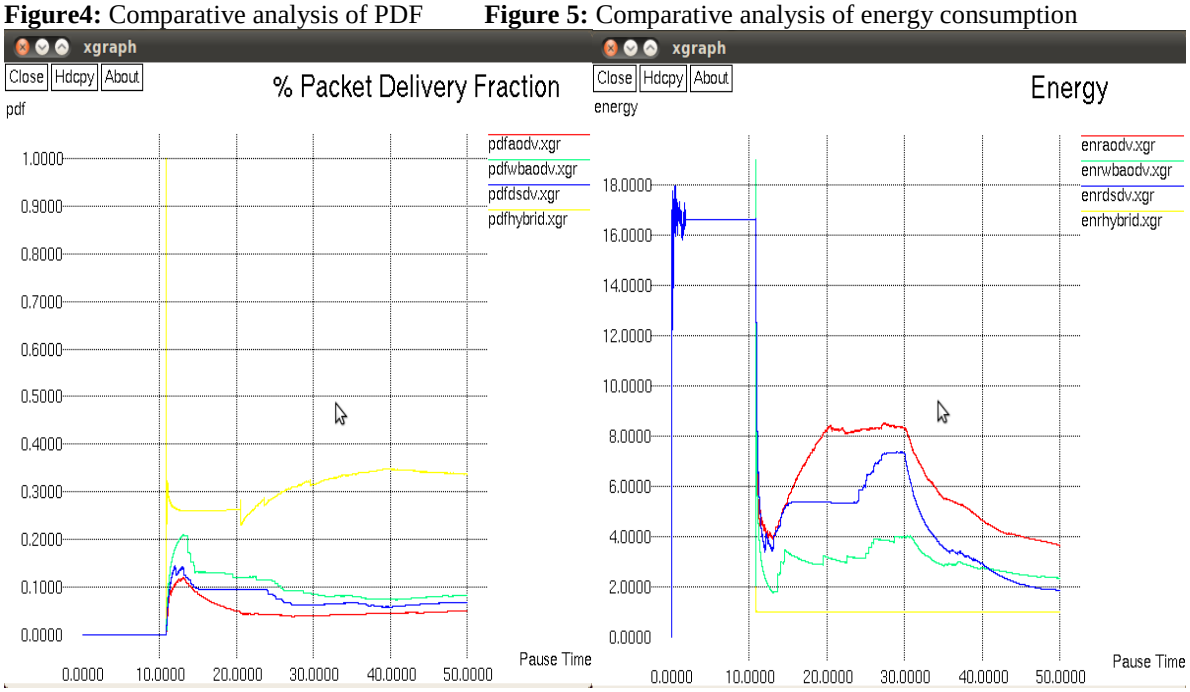


Figure4: Comparative analysis of PDF **Figure 5:** Comparative analysis of energy consumption



IV. CONCLUSION

The current research work proposed a hybrid protocol (a combination of on demand adhoc and table driven protocols) to have a long lifetime, reliability, and effeicient performance in WSN. The various parameters such as; end to end delay, throughput, PDF and energy consumption are examined and compared in simulator 2. The performance of hybrid protocol is found better in terms of lower end to end delay, higher throughput, Increase in PDF and less consumption of energy as compared to AODV, WBAODV and DSDV.

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