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Energy Efficient Ad hoc on Demand DREAM Routing in Wireless Ad Hoc Network

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***ABSTRACT*:**

In Wireless Ad hoc Network nodes are forming the temporary connection establishment in between sender and receiver through intermediate nodes. The nodes are uses the limited power or energy for routing packets or performing any function in the network. Due to that the energy efficient routing is the significant issue in Wireless Ad hoc Network. In dynamic network the connection lost and re-establishment consumes more energy in routing. In this paper we proposed a new energy efficient Ad hoc On Demand location based routing protocol (EAODV-DREAM) for improving the routing performance and energy utilization in Wireless Ad hoc Network. The only Energy based AODV (EAODV) routing protocol are not able to handle the connection stability in dynamic network. The proposed routing technique is utilizes the battery power consumption and also the node energy are utilized for data sending, receiving and forwarding. The location DREAM protocol is playing a vital role for maintaining the location of mobile nodes with the mobility speed. The DREAM has minimizes the control overhead in network and due to that the energy of mobile nodes are also utilizes for data sending and receiving. The TCP connection analysis of sending receiving and drop in between sender and receiver is shows the EAODV is send and receive less number of packet and also drop is more but the proposed routing is improves with greater energy utilization.

***Index Terms*—**Ad hoc Network, Routing, Energy, AODV, DREAM,

i INTRODUCTION:

A Wireless Ad Hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any established infrastructure or centralized administration [1]. The absence of any fixed infrastructure, such as access points, makes Ad hoc networks prominently different from other wireless LANs. In such an background each node in its surrounding may act as a router, source and destination, and forwards packets to the next hop permitted them to reach the final destination through multiple hops.

A Wireless Ad Hoc network consists of mobile platforms (e.g., a router with multiple hosts and wireless communications devices) – herein simply referred to as "nodes" - which are free to move about arbitrarily. The nodes may be located in or on airplanes, ships, trucks, cars, perhaps even on people or very small devices, and there may be multiple hosts per router. A Wireless Ad Hoc network is an autonomous system of mobile nodes. This means that it can forward packets to other nodes. Many applications of Wireless Ad Hoc network are

implemented and used until today like in meeting conferences; military operations; search and rescue operations, all of them are examples of Wireless Ad Hoc network [2].

With the proliferation of portable computing platforms and small wireless devices, Wireless Ad Hoc networks have received more and more attention as a means for providing data communications among devices regardless of their physical locations. The main characteristic of Ad-Hoc networks is the absence of pre arrangement. The topology of the network is discovered on the fly, after the network's deployment. Thus, such a network must exchange a number of messages which are used to "set-up" various parameters in the network. Example of such parameters is the very existence of other nodes in the network, their position, information about their neighbors, what they offer (e.g., local maps, files, printing facilities etc) [2].

Energy is consumed in Wireless Ad Hoc network during the transmission and reception of data, propagation of control packets, retransmission and eavesdropping [3]. The location based DREAM [4] protocol is maintain the location information of mobile nodes to reduces the routing packets flooding. We concentrate in reducing the power consumption during the transmission and reception of data. Each node in Wireless Ad Hoc network transmits data with the maximum energy and also in transmission maximum energy is consumed Wireless Ad Hoc network. Also the mobile nodes expend some energy in transmission and reception of data. We have utilized the metrics received signal strength, link quality and the distance between the nodes to compute the energy required to transmit the data from a node to its neighboring node. The energy computed is involved in the selection of the optimal path which requires minimum energy to route the data from source to destination [5].

The location based DREAM protocol in this paper is considered for routing with AODV protocol. The energy efficient routing factor is included to realize the importance of location information. The proposed EAODV-DREAM protocol is energy based On demand DREAM protocol for improving energy utilization in Wireless Ad hoc Network.

II. ROUTING PROTOCOL DESCRIPTION

In order to facilitate communication within the network, a routing protocol is used to discover routes between nodes [6]. The primary goal of such an ad hoc network routing protocol is to provide an efficient route establishment between a pair of nodes so that messages may be delivered in a timely manner. Route construction should be done with a minimum of overhead and bandwidth consumption.

The routing protocols are categorized by three types in Wireless Ad hoc Network.

i. Proactive Routing Protocol

The proactive routing protocols are forming the tables for routing in dynamic network. In this type of routing the table information is creating and if the node is forwarded the data then

first check the route information in its routing table if present then forward data if not then enter this information and then forward data. The route record is maintained at the time of connection establishment. DSDV [7] is the proactive routing protocol.

ii. Reactive Routing Protocol

The reactive routing protocol is the On demand routing protocol that forming the connection only on the basis of demand of sender or intermediate nodes. The routing information is only maintained up to data delivery in network. If the whole communication is completed i.e. start with connection establishment to final data deliver, the route information is sustain but after data delivery the complete route information is destroyed. AODV [8] is the Reactive Routing Protocol.

iii Hybrid

The hybrid routing protocol is contain the property of both the routing protocols like proactive and reactive routing protocol. This protocol has done both types of routing. The ZRP [9] is the Hybrid routing protocol.

III. Previous Work Done in this Field

The previous researchers are proposed the solutions of energy efficient position based routing are discussed here:

In this research [10] paper is presenting an Energy-Efficient Routing protocol that will improve the utilization of link by balancing the energy consumption between utilized and underutilized nodes to meet the above challenge. The protocol deals with various parameters as Residual Energy, Bandwidth, Load and Hop Count for route discovery. The failure of any node in the route when the transmission of data packet is in progress leads to the degradation of the QoS (Quality of Service). To overcome with this issue, the paper proposes two methods for maintenance of the route. A drawback of this research is:

1. The routing cache information of DSR is decided the route on the basis of residual energy, load and available bandwidth but the load threshold is not given so that it the load is under available bandwidth why calculate load.
2. The residual energy based routing section is not clear on which energy condition nodes are not selected in routing.
3. The initial energy of nodes are same or different are not mentioned.
4. Only the route position information is stored in DSR cache not the location and mobility information is stored.
5. The routing calculation after the one successful data receiving is more due to that the control overhead is more and delay increases that a not evaluated in this paper.
6. In proposed EAODV-DREAM energy efficient scheme we proposed simple routing scheme and evaluated the absence performance analysis in [10] with clear node energy level.

Wei Liu et. al has proposed “DELAR: A Device-Energy-Load Aware Relaying Framework for Heterogeneous Mobile Ad Hoc Networks” [11] and researcher focus work on the cross-

layer designed Device-Energy-Load Aware Relaying framework, named *DELAR*, to achieve energy conservation from multiple facets, including energy-aware routing, transmission scheduling and energy control. In particular, they design a novel power-aware routing protocol that satisfactorily incorporates device heterogeneity, nodal remaining energy information and nodal load status to save energy. In addition, they develop a hybrid transmission scheduling mechanism, which is a mixture of reservation-based and contention-based medium access control schemes, to coordinate the data transmissions. Moreover, the novel notion of "mini-routing" is introduced into the data link layer and an Asymmetric MAC (A-MAC) scheme is proposed to support the MAC-layer acknowledgements over unidirectional links caused by asymmetric transmission power levels between powerful nodes and normal nodes. Furthermore, they present a multi-packet transmission scheme to improve the end-to-end delay performance.

Ying Zhu et. al has been proposed a "Energy-Efficient Topology Control in Cooperative Ad Hoc Networks" [12] in this work researcher introduce a new topology control problem: name is energy-efficient topology control problem with cooperative communication, and proposed two topology control algorithms to build cooperative energy spanners in which the energy efficiency of individual paths are guaranteed. both proposed algorithms can be performed in distributed and localized fashion while maintaining the globally efficient paths by proposed mechanism and control the topology change behaviour on the bases of energy efficient mechanism.

Vinay Rishiwal et. al [13] in his work titled "Power Aware Routing in Ad Hoc Wireless Networks" they propose an efficient algorithm and maximizes the network lifetime by minimizing the power consumption during the source to destination route establishment. As on thier case study proposed algorithm has been incorporated along with the route discovery procedure of AODV and by simulation it is observed that proposed algorithm's performance is enhanced as compare to AODV and DSR in terms of various energy base parameters like total Energy Consumption, Average Energy Left Per Alive Node, Node Termination Rate, and Network Lifetime for different network scenarios.

Dahai Du, Huagang Xiong in [14] proposed location aided protocol. The development of GPS technology makes it possible to use the low cost Global Position System (GPS) in the mobile node, which knows its geographical location. Though GPS may consume some energy, the LEER protocol consumes less energy with the aid of nodes location information. This is because the location information can help the relaying nodes to find the destination nodes with less route discovery messages. Based on this, any node in the network can get its coordinate with the aid of GPS.

Natarajan Meghanathan in [15] proposed a new MANET routing protocol called "Location Prediction Based Routing" (LPBR) protocol that simultaneously minimizes the number of route discoveries as well as the hop count of paths used for a source-destination session. We assume all the nodes are position-aware using techniques like Global Positioning Systems

(GPS) and the clocks across all nodes are synchronized. The number of route discoveries is often significantly low compared to Source Routing (DSR) [6] and the stability based Associativity Based Routing (ABR) [7], Flow Oriented Routing Protocol (FORP) [8] and Route-lifetime Assessment Based Routing (RABR) [9]. This indicates the effectiveness of the location prediction approach in LPBR. As there exist no single routing protocol that simultaneously minimizes the number of route discoveries as well as the hop count per path.

IV. Ad hoc On Demand DREAM Routing

The Energy efficient Location based routing protocols that know the physical Location of the nodes have a feature to restrict the propagation of RREQ packets in surrounding range. However, the geographic knowledge is not available in many scenarios. Many routing protocols use historical information to restrict the RREQ flooding within a limited region of the network. The initial battery capacity of nodes is in joules and considered different initial energy of each node. This initial energy is progressively reduced by data transmission/reception. When it reaches zero units, the corresponding node cannot take part any more in the communication, and is regarded as died.

In the absence of positioning service, we need a method to estimate the distance or direction to the destination. Thus, we combine the position-based routing features into On demand AODV routing protocols with DREAM and propose an location based routing protocol (EAODV_DREAM) to improve the route discovery.

In this implementation we are looking for the solution for the problem mentioned above with the help of different kind of methodologies (algorithm). We propose an algorithm to estimate the distance of two nodes though DREAM location protocol. The flooding for finding is receiver is minimized by DREAM that also produces reduction in overhead. In the proposed energy efficient Algorithm EAODV-DREAM for overhead reduction, the following steps are:-

Step 1: Source broadcasts the Route Request (RREQ) packets through AODV routing protocol with consideration of energy factor (EAODV) which are heard by nodes within the considered radio range.

Step 2: The neighboring nodes forward the route request to next neighbors if the destination is not found in network.

Step 3: The nodes are consumes energy in every RREQ and RREP.

Step 4: Destination sends Route Reply (RREP) only to the first received Route Request and also the destination sends the location information and mobility speed to sender through DREAM protocol.

Step5: The Every node in network maintains the location information and mobility speed through DREAM protocol.

Step 6: Source address, destination address, Location Information and previous node addresses are stored during route reply.

Step 7: The data packet contains only source & destination addresses in its header and sufficient energy for data transmission.

Step 8: When the data packet travels from source to destination, through intermediate nodes and also the energy of nodes are consumed for transmission and receiving.

Step 9: After the data packet transmission the communication is complete but the location information is maintained through DREAM protocol.

Step10 : Stop

This is very important proposed routing protocol concept because it can reduce the energy consumption of path failures and route discoveries. By the combination of exclusion of weak links and utilizing the advantage of proposed to steer the estimation direction of RREQ packets to the general direction of the destination, the protocol can significantly reduce the routing overhead, energy consumption and improve the routing performance in dense or high-mobility networks.

Simulation Environment

NS-2 (Network Simulator) is an open-source event-driven simulator [16] designed specifically for research in computer communication networks. Since its inception in 1989, NS2 has continuously gained tremendous interest from industry, academia, and government. Having been under constant investigation and enhancement for years, NS2 now contains modules for numerous network components such as routing, transport layer protocol, application, etc. To investigate network performance, researchers can simply use an easy-to-use scripting language to configure a network, and observe results generated by NS2. Simulation can be done by using the Network Simulator implemented in software and are valuable tools for researchers to develop, test and diagnose network protocols.

This simulation environment is consists of 50 wireless mobile nodes which are placed uniformly and forming a mobile ad hoc network, moving about over a 800 x 600 meters area for 100 seconds of simulated time. All mobile nodes in the network are configured by Ad hoc On Demand Multipath Distance Vector (AOMDV) protocol. The routing protocols are evaluated with IEEE 802.11. All nodes are de routing as AOMDV routing procedure. The nodes mobility speed is random with maximum velocity of 30 m/s. The packet size of data is of 512 bytes and in a one second about 3packets/second is sending in network. The traffic connection is of type TCP and UDP and the traffic type is of CBR and FTP.

Results Evaluation

In this section, we show the performance comparison of the proposed scheme with normal Energy based AODV routing. The performance of the proposed EAODV-DREAM is better with efficient energy utilization.

Control Packets Analysis

The control Overhead packets in network are broadcasting by sender in network for finding the destination in dynamic network. The intermediate nodes are forward the control packets that are sends by sender. After the connection establishment through control packets the data sending and receiving si started in between sender and receiver. In this graph the control overhead analysis of EAODV and proposed EAODV-DEAM is analyzed and observe that due to more control overhead of EAODV the more energy is consumed for communication in network. In EAODV routing about 1500 packets are deliver but in EAODV-DREAM the overhead is about 1350 packets up to end of simulation. The performance of proposed routing scheme is better and utilizes energy for data receiving in wireless ad hoc network.

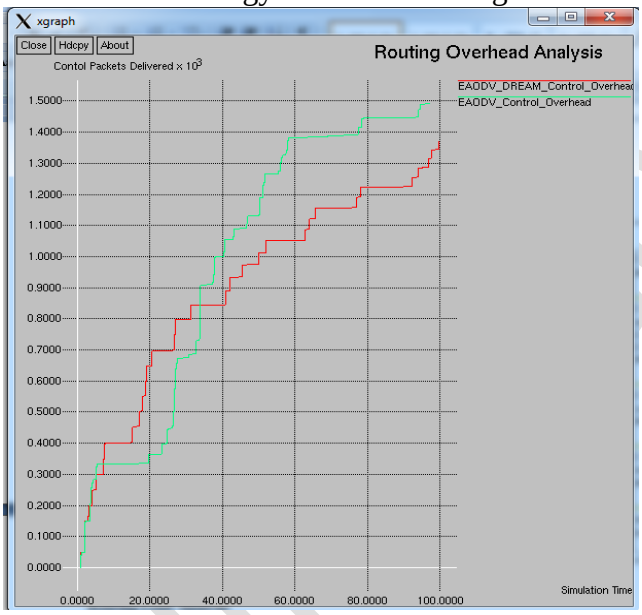

Fig. 1 Control Overhead Analysis

TCP End Packets Analysis of EAODV

The performance data packets sending and receiving of EAODV at TCP End to End communication is mentioned in table1. In this table four senders and receives are consider. The nodes energy is depleted in every commutation for transmission, receiving and receiving and forwarding of intermediate nodes. Here at TCP only the node 6 has reaches to thousands packets and rest of them are under thousand. The total drop packets are calculated here (sends-Receives) = 124.

Table 1 TCP Analysis of EAODV

Nodes Send	EAODV-TCP Data Packets Sends	Nodes Received	EAODV-TCP Data Packets Received
5	793	21	757
6	2724	12	2675

10	966	29	932
25	12	24	7
Total Packet Sends	4495	**Total Packet Receive**	4371

TCP End Packets Analysis of EAODV-DREAM

The TCP end packets sending and receiving analysis of EAODV-DREAM is mentioned in table 2. Here the DREAM protocol are improving the routing performance of EAODV protocol by that the packets sending and receiving is get better. Here about 2000 more send and receives in network. It implies that the link breakage and energy consumption is reduces. Also due to the awareness of location control packets flooding also minimizes. Here the total packets are drop about 101in network with more sending and receiving as compare to base EAODV.

Table 2 Table 1 TCP Analysis of EAODV-DREAM

Nodes Send	**EAODV- DREAM TCP Data Packets Sends**	**Nodes Received**	**EAODV- DREAM TCP Data Packets Received**
5	2064	21	2021
6	1644	12	1622
10	2212	29	2212
25	569	24	533
Total Packet Sends	6489	Total Packet Receive	6388

TCP End Packets Drop Analysis of EAODV and EAODV-DREAM

The packets drop analysis of EAODV and proposed EAODV-DREAM is mentioned in table 3. The packets drop by intermediate nodes is mentioned here and observe that in EAODV-DREAM the packets drop by senders and only one intermediate node 22. The packet dropping is about 98 and the rest of the remaining 3 packets are drop at receiver end. In EAODV protocol the packets dropping is 97 because of intermediate nodes and only one sender rest of the 27 packets are drop at receiver end. The packets dropping at receiver end is more in EAODV that is degrades proposed EAODV-DREAM routing and improves packets receiving.

Table 3 TCP Packets Drop Analysis

EAODV-DREAM		**EAODV**	
Drop Node	Total TCP Pkt	Drop Node	Total TCP Pkt Drop

	Drop		
5	44	3	4
6	21	5	19
22	4	6	31
25	29	10	18
		11	13
Total TCP Packet Drop	**98**	16	4
		17	1
		41	5
		46	2
		Total TCP Packet Drop	**97**

CONCLUSION WITH FUTURE EXTENSION

The Proposed Location based DREAM with Energy AODV (EAODV) routing protocols can efficiently control the flooding of packets in every direction by that energy consumption utilizes in data delivery as compare to propagation routing packets. In addition, in the proposed approach the DREAM protocols need to maintain the position of the destination as respect to all other nodes that are interact or participating in routing. To maintain the location table accurately, each node needs to periodically broadcast its own coordinates to the network which incurs additional overhead. Since conventional on demand routing protocols do not have any positioning service, it is difficult to exactly control the propagation of RREQ packets. The EAODV-DREAM is improves the network performance and utilizes energy consumption in Wireless Ad Hoc Network.

In future we evaluated the some more routing results and location information of mobile nodes separately that are stored in simulation (.tr) trace file. Through DREAM location protocol information at the time of routing, the flooding of packets are minimize and routing load decreases delay minimizes, throughput increases and also prolog the network life time in terms of energy. These performance analyses are measured and discussing in future.

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