Implementation of Chain Based Technique for Enhancement of Energy Efficient Routing with Various Node Density in MANET Environment

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ABSTRACT

In spite of the fact that setting up right and efficient routes is an essential structure issue in mobile ad-hoc networks (MANETs), an all the more difficult objective is to give energy proficient courses since mobile nodes' activity time is the most basic restricting component. This paper focuses on investigating the performance analysis of three important reactive routing protocols in mobile Ad-hoc networks such as Power Efficient Gathering in Sensor Information System (PEGASIS) Dynamic Source Routing (DSR) and Ad-Hoc on Demand Distance Vector Routing (AODV). The comparison was done in terms of the Packet Delivery ratio, throughput, routing overhead and residual Energy scenario. The simulation results show that the PEGASIS seems to be much better suited to smaller high load network with a hierarchical in table driven protocol such as AODV and DSR. PEGASIS outperforms AODV and DSR whereas PEGASIS maintains its low energy consumption even in the presence of high traffic rate.

Keywords:- MANET, AODV, DSR, PEGASIS and NS-2.35.

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I. INTRODUCTION

Ad-hoc network is one of the emerging trends in wireless communication. In conventional wireless communication there is need of base station for communication between two nodes. These base station leads to more infrastructure and more cost. An ad hoc network facilitates communication between nodes without the existence of an established infrastructure. Nodes are connected randomly using ad-hoc networking and routing among the nodes is done by forwarding packets from one to another which is decided dynamically. In general, MANET's are formed dynamically by an autonomous system of mobile nodes that are connected via wireless links without using any centralized administration [1]. Mobile nodes that are within each other's radio range communicate directly via wireless links, while those that are far apart rely on other nodes to relay messages as routers. Node mobility in an ad hoc network causes frequent changes of the network topology. The scopes of the ad-hoc network are also associated with dynamic topology changes, bandwidth-constrained, energy constrained operation, limited physical security,

mobility-induced packet losses and limited wireless transmission range, broadcast nature of the wireless medium, hidden terminal problem and packet losses due to transmission errors [2].

In Energy constrained operations, it is important to save energy which results in improvement in network lifetime. For example, in battle fields soldiers are unable to charge node batteries so there is need for them to save battery power in such a way that communication can be possible for longer time. To improve network lifetime there are different methodologies used at different layers of OSI model. Network layer is used for routing of packets from source to destination. There are number of routing protocols defined in MANET, for example AODV, DSR and PEGASIS etc. The main objective is to design routing protocol in such a way that it works effectively in energy constrained applications. The main focus is on PEGASIS routing protocol modification in network layer.

The paper is organized as follows. Section II explains different types of routing protocols. Section III discusses the basics of routing protocol and study of related energy aware techniques, Section IV represents the simulation details and setup. Section VI discusses results obtained by Network simulator-2 for QoS. Finally section V concludes the paper.

II. ROUTING PROTOCOL IN MANET (CLASSIFICATION)

The classification of routing protocols in MANET might differ depending on the application are,

- Operation based Routing Protocol.
- Network Structure based Routing Protocol.

This classification of routing protocol is shown in Figure:

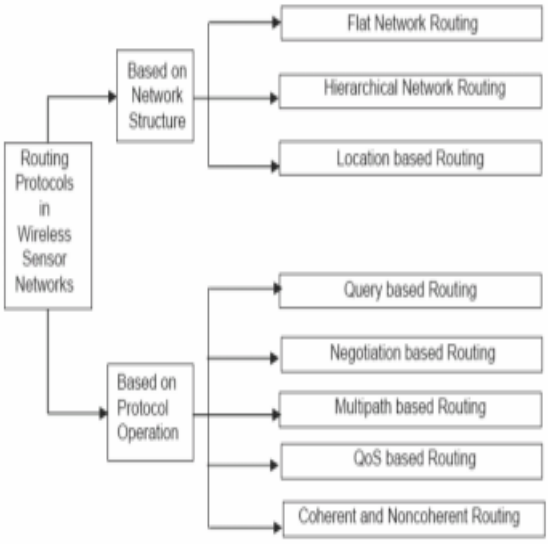

Figure 1:- Classification of Routing Protocols in MANET

PEGASIS Protocol (Power Efficient Gathering in Sensor Information System)

In mobile ad-hoc network, Data handling is accomplished by data dissemination and data gathering. A routing protocol is a protocol that determines how routers (Sensor nodes) convey with each other, propagating information that permits them to preferred routes between any two nodes on the network. The prime route being done by applied routing algorithms. Each router has awareness only of the networks attached to it directly. A routing protocol proportion this information first between existing neighbors, and then throughout the network. This way, routers achieve knowledge of the topography of the network.

In data-gathering application, all data from all nodes need to be collected and transmitted to the base station (BS) by a leader node, where the end-user can approach the data. A simple approach to accomplishing this data gathering assignment is for entire nodes to transmit its data directly to the BS. The goal of algorithm which implement data gathering is maximize the numbers of rounds of communication before the nodes die and the networks becomes ruined. This means minimum energy should be exhausted and the transmission should occur with minimum delays, which are incompatible requirement. Hence, the energy x delay metrics used to compare algorithms, since this it measures speedy and energy-decisive data gathering.

AODV (Ad-Hoc on Demand Distance Vector Protocol)

The Ad hoc On Demand Distance Vector (AODV) routing algorithm is a routing protocol designed for ad-hoc mobile networks. AODV is capable of both multicast and uncast routing. It is an on demand algorithm, means that it figure routes between nodes only as desired by source nodes. It maintains these routes as long as they are used by the sources. Additionally, AODV designs tree topography which connects multicast group members. The trees are composed of the group members and the nodes required attaching the members. AODV uses sequence numbers to ensure the freshness of routes. It is loop-free, aggressive and extent to broad numbers of mobile nodes. AODV figure routes using a route request / route reply query cycle. While a source node desires a route to a destination for which it does not already have a route, it disseminates a route request (RREQ) packet across the network. Nodes receiving this packet update their information for the source node and set up rearward pointers to the source node in the route tables. In addition to the current sequence number, source node's IP address, and broadcast ID, the RREQ also contains the most recent sequence number for the destination of which the source node is cognizant.

The main advantage of this protocol is having routes established on require and that destination sequence numbers are applied for find the latest route to the destination. The connection setup detain is lower. One disadvantage of this protocol is that intermediate nodes can lead to inconsistent routes if the source sequence number is very former and the intermediate nodes have a higher but not the latest destination sequence number, thereby having stale entries. Also, more than one Route Reply packets in response to a single Route Request packet can lead to heavy control overhead. Another disadvantage of AODV is unneeded bandwidth consumption due to periodic beaconing.

Dynamic Source Routing (DSR) DSR is a protocol that was introduced for routing in mobile Ad-hoc networks and brought forth for MANET by Brooch, Johnson, and Maltz [3,4,8]. In brief, the nodes deliver a ROUTE REQUEST message, where all nodes which get this message will be set in the source route and forwarded to their neighbors, unless they have received the same request previously. If a receiving node has a route to the destination, the request is not forwarded, but a REPLY message informing about the full source route is sent. The answer may be committed along the source route reversibly or a ROUTE REQUEST is issued including the route to return to the source, if the former is not regarded to be possible due to asymmetrical connections. ROUTE REPLY messages can be provoked by ROUTE REQUEST messages. After receiving several routes at most, the source picks out the best, by default the shortest, having it stored and messages sent through the path. The better the route metrics, i.e. number of hops, delay, bandwidth, or other criteria, the faster the REPLY reaches the source. The higher the preference granted to the route and the longer it will stay in the cache. When a ROUTE REPLY arrives soon after a ROUTE REQUEST is sent, this may highlight the existence of a short path, since the nodes are usually required to wait until a time to correspond with the length of the route, they can advertise before having it posted. This is done to overcome abundant replies [5]. If a connection fails, the node that is not able to forward the packet to the next node will present an error message to the author. Routes that have broken links can be rescued by taking an optional partial path that has no bad link. The former advantage Dynamic Source Routing protocol that is use source routing, also it is on-demand protocol which nodes are allowed to find out a route over network dynamically [4,6,8]. The good idea behind the use of source routing back to the backed headers of DSR is to have a complete list of nodes duration that they will sink to reach its distance. There is no mechanism of route discovery packed of broadcasting in DSR. This will bring down the overhead bandwidth network. If there is a better route, then the node will update their route cache. The DSR has two modes of processing; route discover and route maintained [3,7]. Figure 2 shows

the initiate of Route Discovery in which a node S transmits a Route Request message attempting to discover a route to node D. Then, all nodes will receive within wireless transmission range of D. Each Route Request message identifies the source and destination of the Route Discovery. This route record is initialized to an empty list by the source of the Route Discovery.

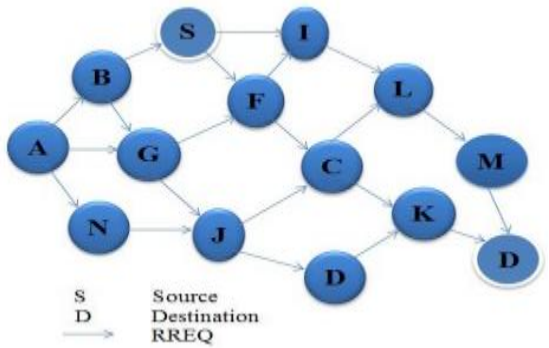

Figure 2:- An Example of Route Request: Node S is the source and Node D is the destination

When another node receives a Route Request as a destination of the Route Discovery, it returns a Route Reply message to the source, giving a copy of the accumulated route record from the Route Request; then the source will caches this Route Reply and use it to send subsequent packets to this destination [8]. Otherwise, if this node receiving the Route Request that has recently seen from another Route Request message, this source bearing this same request ID, or if it finds that its own address is already listed in the route record then, it discards the request. Otherwise, this node will add its own address to the route record and propagates it by transmitting it as a local broadcast packet, as shown in Figure 3. Finally, it avoids routing loops easily because the complete route is determined by a single node instead of making the decision hop-by-hop.

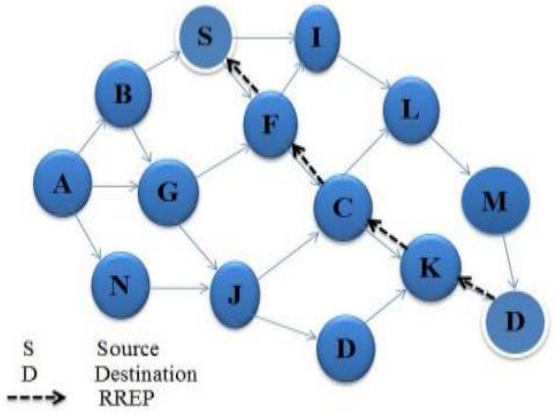

Figure 3:- An Example of Route Reply: Node S is the source, and Node D is the destination

III. SIMULATION SETUP

Network size is considered as 1500m X 1500m and the numbers of nodes are 25, 50, 75, 100 and 125 which are scattered randomly in the sensor field. Parameters for our simulation are as follows:

Simulation TOOL	Network Simulator-2.35
IEEE Scenario	WSN(IEEE 802.15.4)
Network Interface	Physical/Wireless Physical
Mobility Model/Propagation	Two Ray Ground
Link Layer	LL
No. Of Nodes	25, 50, 75, 100, 125
Traffic Type	TCP
Antenna	Omni Directional Antenna
MAC Layer	IEEE 802.11
Routing Protocols	AODV,DSR, PEGASIS
Queue Limit	50

Simulation Area(in metre)	1500*1500
Queue type	Droptail
Channel	Wireless Channel
Simulation Time	100 sec.

IV. SIMULATION RESULT AND ANALYSIS

This work comprises of MANET protocols with three routing protocols i.e. AODV, DSR and PEGASIS in consideration. We performed an enhancement study by implementing respective protocols on a custom generated topography. The performance of PEGASIS protocol is being evaluated with comparison of AODV and DSR routing protocol with the use simulator. For simulation we have used NS-2 and tested PEGASIS protocol performance with AODV and DSR. For performance evaluations following parameters are taken into account:

Packet Delivery Ratio: - Packet Delivery Ratio is the proportion of the ratio of the number of data packets received by the destination node to the number of data packets sent by the source node.

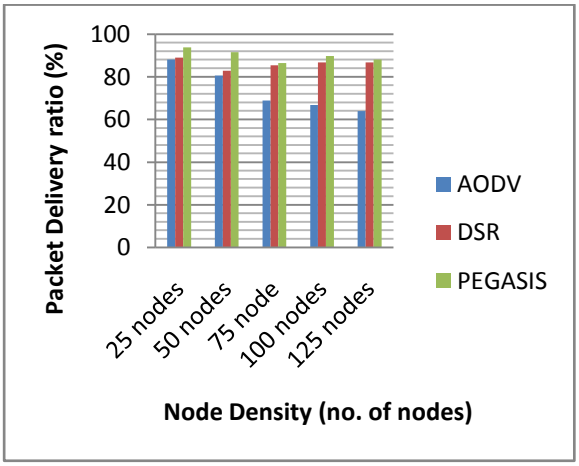

Figure 4:- Packet Delivery Ratio with various node density

Throughput: - Throughput is the average rate of successful message transmitted over a communication channel.

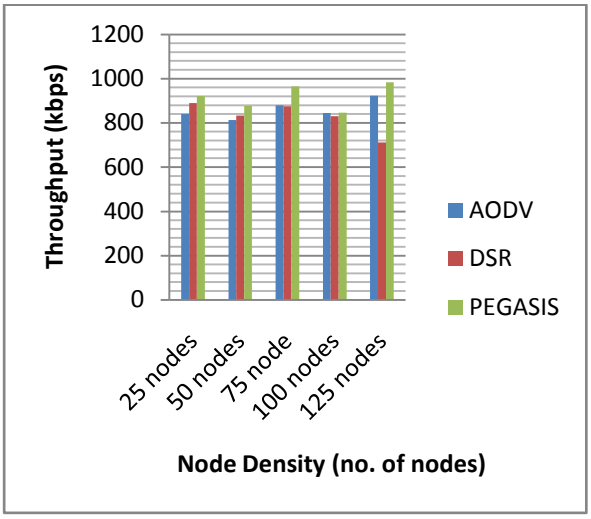

Figure 5:- Throughput with various node density

Normalized Routing Load: - Number of routing packets (and supporting protocol control packets) transmitted per data packet delivered at the destination.

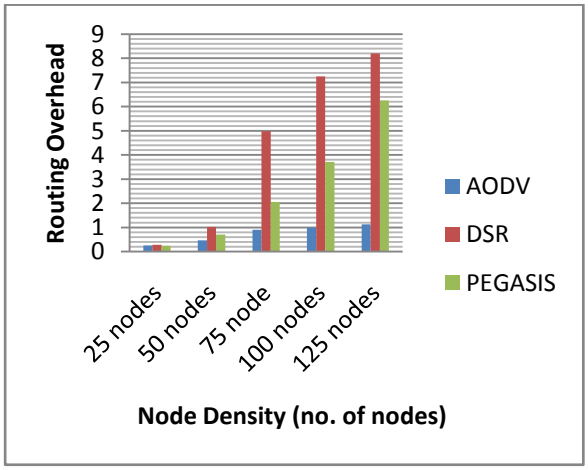

Figure 6:- Routing Overhead with various node density

Residual Energy: - It is the remaining amount of energy or power after completing the whole communication process**.**

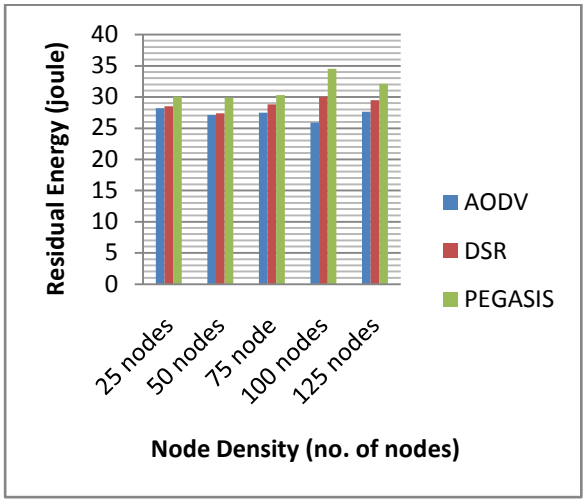

Figure 7:- Residual Energy with various node density

V. CONCLUSION

We actualized a vitality proficient PEGASIS progressive directing strategy in which chain pioneers are chosen arbitrarily. Our methodology applies a chain development of sensor nodes into chains, choosing the chain chief arbitrarily in each round of reproduction, and social affair information before transmission to the BS. The essential component which incorporates chain development, chain pioneer choice and chain arrangement enhancement of our proposed various leveled steering technique(PEGASIS) in transmitting information to the BS (base station) was investigated and stressed, this examination demonstrates that vitality effectiveness of MANETs can be furthermore enhanced by utilizing the progressive directing strategy. The various leveled steering approach can be efficaciously used to structured vitality productive directing protocol in MANET. In this methodology, the chains are framed into various sizes to perceive how it could influence the system lifetime of MANET With energy efficient PEGASIS protocol being our center enthusiasm for this work, our proposed progressive strategy, which utilizes the easy calculation to send information to the BS confirmation to offer increasingly diminished vitality utilization and furthermore increment the lifetime of the WSN. From the investigation of our analyzed results, we concluded that PEGASIS protocol offers a superior answer for energy efficient use in a MANET when contrasted with other routing protocol, like AODV and DSR.

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