DYNAMIC ALGORITHM IN MOBILE AD-HOC NETWORKFOR SAVING ENERGY CONSUMPTION

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ABSTRACT

This paper is based on mobile ad hoc network (MANET). As it is seen there is a rapid change in the technology or technology will increase , diverse sensing and mobility capacities has become available to the devices and consequently the mobile ad hoc network (MANET) are used to perform so many important task related to it. In this paper the proposed work related with the power or energy of node wills efficiently used with the dynamic path algorithm which is named as EESRDA (Energy Efficient source Routing Using Dynamic Algorithm). The node above minimum battery power will not include in the shortest path routing. This will increase the life of the network. In this project work we use dynamic source routing protocol by which we can find out the shortest path among the different node. The energy efficient metric which will use to manage the power consumption. In our work we mention the number of node with their battery power, path, distance, and connectivity with each other. As we find the shortest path and particular network is used many times the battery is being consumed. If battery power is below the minimum the particular will change and another shortest path used for the network for further communication. By doing this work we surely get the benefit of using the network connectivity for long time, which will give the maximum utilization of the network and the throughput.

Keywords: ***EESRDA, MANET, Dynamic Path, Shortest Path, Mobility***

I. INTRODUCTION

MANET Stands for "Mobile Ad Hoc Network." A MANET is a type of Adhoc network that can change locations and configure itself on the fly. Because MANETS are mobile, they use wireless connections to connect to various networks. This can be a standard Wi-Fi connection, or another medium, such as a cellular or satellite transmission.

Some MANETs are restricted to a local area of wireless devices (such as a group of laptop computers), while others may be connected to the Internet. For example, A VANET (Vehicular Ad Hoc Network), is a type of MANET that allows vehicles to communicate with roadside equipment. While the vehicles may not have a direct Internet connection, the wireless roadside equipment may be connected to the Internet, allowing data from the vehicles to be sent over the Internet. The vehicle data may be used to measure traffic conditions or keep track of trucking fleets. Because of the dynamic nature of MANETs, they are typically not very secure, so it is important to be cautious what data is sent over a MANET.

1.1 Applications of Manets

1.1.1. Military Scenarios: MANET supports tactical network for military communications and automated battle fields.

1.1.2. Rescue Operations: It provides Disaster recovery, means replacement of fixed infrastructure network in case of environmental disaster.

1.1.3. Data Networks: MANET provides support to the network for the exchange of data between mobile devices.

1.1.4. Device Networks: Device Networks supports the wireless connections between various mobile devices so that they can communicate.

1.1.5. Free Internet Connection Sharing: It also allows us to share the internet with other mobile devices.

1.1.6. Sensor Network: It consists of devices that have capability of sensing, computation and wireless networking. Wireless sensor network combines the power of all three Of them, like smoke detectors, electricity, gas and water meters.

II. ROUTING

In internetworking, the process of moving a packet of data from source to destination. Routing is usually performed by a dedicated device called a router. Routing is a key feature of the Internet because it enables messages to pass from one computer to another and eventually reach the target machine. Each intermediary computer performs routing by passing along the message to the next computer. Part of this process involves analyzing a *routing table* to determine the best path.

Routing is often confused with *bridging*, which performs a similar function. The principal difference between the two is that bridging occurs at a lower level and is therefore more of a hardware function whereas routing occurs at a higher level where the software component is more important. And because routing occurs at a higher level, it can perform more complex analysis to determine the optimal path for the packet.

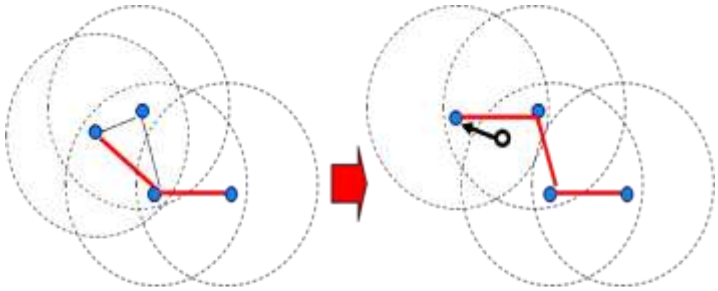
III. ENERGY EFFICIENT ROUTING PROTOCOL

Routing is one of the key issues in MANETs due to their highly dynamic and distributed nature. In particular, energy efficient routing may be the most important design criteria for MANETs since mobile nodes will be powered by batteries with limited capacity. Power failure of a mobile node not only affect the node itself but also its ability to forward packets on behalf of others and thus the overall network lifetime. For this reason, many research efforts have been devoted to developing energy aware routing protocols.

3.1 Routing Protocols

Routing is a very challenging task in mobile ad hoc networks.

- Nodes Mobility and link failure/repair may cause frequent route changes.
- Routing protocol must be distributed, with a minimal overhead.



IV. ROUTING PROTOCOLS CATEGORIES

4.1 Proactive (Table-Driven) Routing Protocols

With table-driven routing protocols, each node attempts to maintain consistent, up-to-date routing information to every other node in the network. This is done in response to changes in the network by having each node update its routing table and propagate the updates to its neighboring nodes. Thus, it is proactive in the sense that when a packet needs to be forwarded the route is already known and can be immediately used. As is the case for wired networks, the routing table is constructed using either link-state or distance vector algorithms containing a list of all the destinations, the next hop, and the number of hops to each destination. Many routing protocols including Destination-Sequenced Distance Vector (DSDV) and Fisheye State Routing (FSR) protocol belong to this category, and they differ in the number of routing tables manipulated and the methods used to exchange and maintain routing tables.

Ex: Destination Sequenced Distance Vector Routing (DSDV), Link State Routing (LSR).

4.2 Reactive (On-Demand) Protocols

With on-demand driven routing, routes are discovered only when a source node desires them. Route discovery and route maintenance are two main procedures: The route discovery process involves sending route-request packets from a source to its neighbor nodes, which then forward the request to their neighbors, and so on. Once the route-request reaches the destination node, it responds by unicasting a route-reply packet back to the source node via the neighbor from which it first received the route-request. When the route-request reaches an intermediate node that has a sufficiently up-to-date route, it stops forwarding and sends a route-reply message back to the source. Once the route is established, some form of route maintenance process maintains it in each node's internal data structure called a route-cache until the destination becomes inaccessible along the route.

Ex: Dynamic Source Routing (DSR), Ad hoc On-demand Distance Vector routing (AODV)

4.3 Hybrid Routing Protocols

Hybrid Routing, commonly referred to as balanced-hybrid routing, is a combination of distance-vector routing, which works by sharing its knowledge of the entire network with its neighbors and link-state routing which works by having the routers tell every router on the network about its closest neighbors.

Hybrid Routing is a third classification of routing algorithm. Hybrid routing protocols use distance-vectors for more accurate metrics to determine the best paths to destination networks, and report routing information only when there is a change in the topology of the network. Hybrid routing allows for rapid convergence but requires less processing power and memory as compared to link-state routing.

Ex: Zone Routing Protocol (ZRP), Zone-based Hierarchical Link State (ZHLS)

V. RELATED RESEARCH WORK

Most of the previous work on routing in wireless ad-hoc networks deals with the problem of finding and maintaining correct routes to the destination during mobility and changing topology. Shortest path algorithm is used in this strongly connected backbone network.

5.1 Reactive Energy-Aware Routing

With on-demand driven routing, routes are discovered only when a source node desires them. Route discovery and route maintenance are two main procedures: The route discovery process involves sending route-request packets from a source to its neighbor nodes, which then forward the request to their neighbors, and so on. Once the route-request reaches the destination node, it responds by uni-casting a route-reply packet back to the source node via the neighbor from which it first received the route-request. When the route-request reaches an intermediate node that has a sufficiently up-to-date route, it stops forwarding and sends a route-reply message back to the source. Once the route is established, some form of route maintenance process maintains it in each node's internal data structure called a route-cache until the destination becomes inaccessible along the route. Note that each node learns the routing paths as time passes not only as a source or an intermediate node but also as an overhearing neighbor node. In contrast to table-driven routing protocols, not all up-to-date routes are maintained at every node. Dynamic Source Routing (DSR) and *Ad-Hoc On-Demand Distance Vector* (AODV) are examples of on-demand driven protocols

5.2 DSR Protocol

Through the dynamic source protocol has many advantages it does have some drawback, which limits its performance in certain scenarios. The various drawbacks of DSR are as follows:- DSR does not support multicasting. The data packet header in DSR consists of all the intermediate route address along with source and destination, thereby decreasing the throughput. DSR sends route reply packets through all routes from where the route request packets came. This increases the available multiple paths for source but at the same time increases the routing packet load of the network. Current specification of DSR does not contain any mechanism for route entry invalidation or route prioritization when faced with a choice of multiple routes. This leads to stale cache entries particularly in high mobility it first received the route-request. When the route-request reaches an intermediate node that has a sufficiently up-to-date route, it stops forwarding and sends a route-reply message back to the source. Once the route is established, some form of route maintenance process maintains it in each node's internal data structure called a route-cache until the destination becomes inaccessible along the route. Note that each node learns the routing paths as time passes not only as a source or an intermediate node but also as an overhearing neighbor node. In contrast to table-driven routing protocols, not all up-to-date routes are maintained at every node. Dynamic Source Routing (DSR) and *Ad-Hoc On-Demand Distance Vector* (AODV) are examples of on-demand driven protocols

VI. GOAL OF PROJECT

Develop a protocol such that

- Reduce and balance the energy consumption of whole communication system
- Increase lifetime of nodes/network until partition

- Increase the delivery rate of packets

VII. ENERGY EFFICIENT ROUTING METRICS

There are three important metrics in power aware routing:

- Minimal Energy Consumption per Packet
- Maximize Network Connectivity
- Minimum Variance in Node Power Level

VIII. PROPOSED SCHEME

8.1 Energy Efficient Source Routing Protocol

- EESR works in a similar manner with DSR, a well-known on demand routing protocol.
- We concentrate on issues of reducing power consumption in transmission mode. There are two ways to achieve this:

1. Using a proper route and proper power to transmit.
2. Reducing routing overhead.

IX. Cost Metric of EESR

- EESR finds a route at route discovery time *t* such that the following cost function is minimized

$$C(\Pi, t) = \sum_{i, j \in \Pi} C_{ij}(t)$$

Where the power cost metric is defined by

$$C_{ij}(t) = (d_{ij})^{\alpha} \left(\frac{F_j}{R_j(t)} \right)$$

- d_{ij} is distance between two nodes *i* and *j*.
- F_j full battery capacity of node *j*,
- $R_j(t)$ remaining battery capacity of node *j* at time *t* *and*
- α is a weighting factor

X. ENERGY EFFICIENT SOURCE ROUTING PROTOCOL

- Instead of using maximum power to transmit all the time, the EESR adjusts the transmission power according to received signal strength.

Received Signal Strength	*Used transmission Power*	*Region*
$P_{r1} < P_r <= P_{r2}$	$P_{t1} = P_{txmax}$	1
$P_{r2} < P_r <= P_{r3}$	$P_{t2} = P_{t1} - (P_{r2} - P_{r1}) + P$	2
$P_{r3} < P_r <= P_{r4}$	$P_{t3} = P_{t1} - (P_{r3} - P_{r1}) + P$	3
$P_{r4} < P_r <= P_{r5}$	$P_{t4} = P_{t1} - (P_{r4} - P_{r1}) + P$	4
$P_{r5} < P_r$	$P_{t5} = P_{t1} - (P_{r5} - P_{r1}) + P$	5

XI. ROUTE DISCOVERY ALGORITHM

a) The Source node initiates the connection by flooding RREQ's to the neighbors and also sets the Cost (Ns) = 0 before sending the request
b) Every intermediate node Ni which are have energy greater than threshold Te, only forwards request to neighbors Nj within its range.
c) On receiving the RREQ every intermediate node starts a timer Tr, computes metric and cost of the path Cost (Nj) = Cost (Ni) +metric(Ni, Nj) as mini-cost.
d) If additional RREQ's arrive with same destination and sequence number within time and the cost of the newly arrived RREQ packet has a lower cost than min cost is changed to this new value, and the new RREQ packet is forwarded otherwise RREQ packet is discarded.
e) Tx-power is also added to RREQ packet, which is computed using received signal strength.
f) The destination waits Tr of seconds after the first RREQ packet arrives. The destination examined the cost of the route of every arrived RREQ packet. When the timer Tr expires the destination selects the route with minimum cost
g) If two or more paths same cost value, the one received first is preferred. Then the destination initiates route reply packet sends it to the source along the reverse path.
h) Every node which is in route reply (route request) adds this route and the value of needed transmission power to its neighbor in its cache table.

XII. ROUTE MAINTENANCE

Route maintenance is needed for two reasons:

1. Mobility: Connections between some nodes on the path are lost due to their movement.
2. Energy Depletion: The energy resources of some nodes on the path may be depleting too quickly.

XIII. IMPROVEMENTS OF EESR OVER DSR

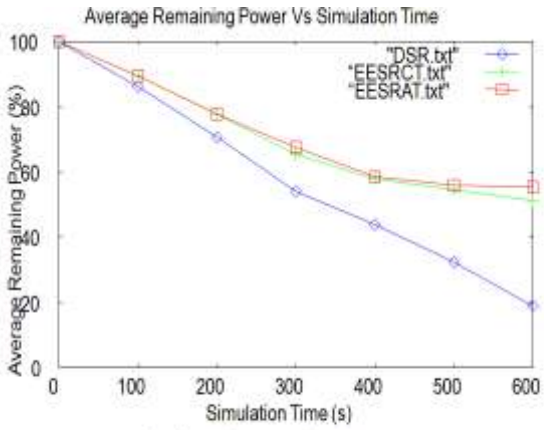
- EESR applies an energy threshold in route discovery.
- New path cost function is used in route selection.
- The transmission power is controlled to the minimum level that packets can be correctly received.

XIV. SIMULATION MODEL

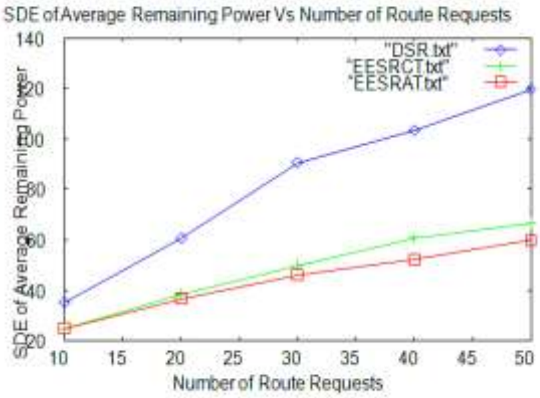
- The maximum transmission power as 281mW (24.45dBm) and calculated the received power levels by using equation for different distances of 250, 200, 150, 100 and 50 and set to Pr1….Pr5.

RECEIVED SIGNAL	USED TRANSMISSION POWER	P
$-64.46 < P_R <= -62.52$	$P_{T1} = 24.45$DBM	-
$-62.52 < P_R <= -60.02$	$P_{T2} = 22.71$DBM	0.2 DBM
$-60.02 < P_R <= -56.50$	$P_{T3} = 20.26$DBM	0.25 DBM
$-56.50 < P_R <= -50.48$	$P_{T4} = 16.79$DBM	0.3 DBM
$-50.48 < P_R$	$P_{T5} = 10.97$DBM	0.5 DBM

XV. SIMULATION RESULT



In the stationary environment



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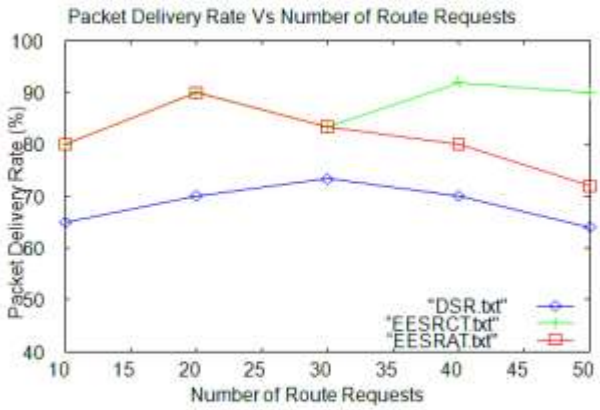

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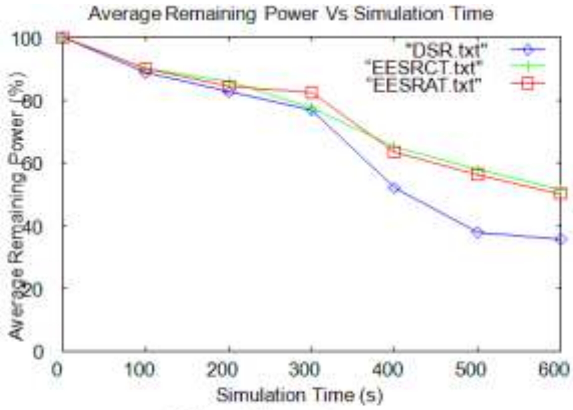
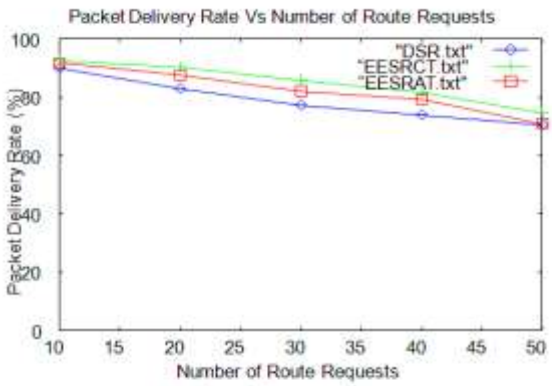


In the mobility environment



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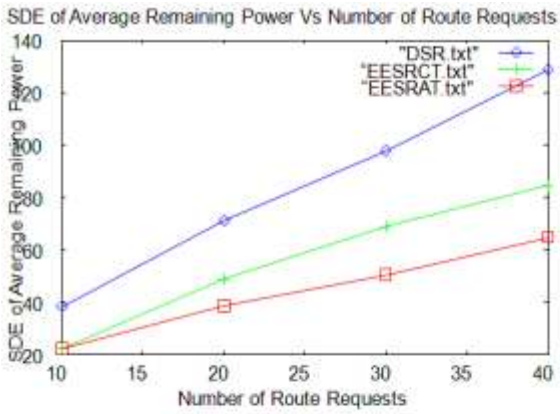

In the mobility environment

XVI. ANALYSIS

The simulation results show that, EESR-AT and EESR-CT Have

- 10 % ~30 % more remaining power than DSR.
- 20 % ~ 50 % lower SDE
- Packet delivery rate about 5% ~15 % higher than DSR.

It proves that the route strategy of EESR leads to more balanced energy consumption, and consequently increases nodes life time as well as network life time.

XVII. CONCLUSIONS

The DSR does not consider the power consumption issue. It finds the route with minimum hops. Such a routing strategy makes nodes run out of their energy very fast. Packet delivery rates also less. We have compared the performance of our protocol EESR with DSR. Based on the comparative study we found that EESR is more efficient than DSR with respect to network lifetime and packet delivery rate.

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