Energy Efficient Ad Hoc On-demand Distance Vector Routing Protocol in MANET

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ABSTRACT

mobile ad hoc network (MANET) is a composed of self configuring large number of mobile nodes which are battery operated and having limited battery. Energy consumption is main issue in MANET. In this paper, propose method is based on AODV which select the route based on min_energy, RSSI value and bandwidth of nodes in the network. The aim of this paper is to extend the network lifetime and reducing a network overhead of nodes in the network. The performance analysis of this proposed protocol is analyzed using network simulator(ns2) and it is compared with existing AODV routing protocol. Simulation results show that this proposes method performance better than existing AODV routing protocol in terms of the metrics: average end-to-end delay, Remaining Energy.

***Keywords*:** *MANET, AODV, RSSI, energy efficiency, bandwidth*

INTRODUCTION

Mobile Ad Hoc Network (MANET) does not have any fixed infrastructure but it is collection mobile nodes which are connected via wireless links. Mobile nodes are free to move in any direction and any way in the network. Every node in ad hoc network behaves as a router as well as a host. The primary applications of ad hoc network are disaster relief operations, military use, conferencing and environment sensing. Many important challenging issues in MANET are Dynamic topology, multi hop routing, limited resources (Bandwidth and battery) etc.

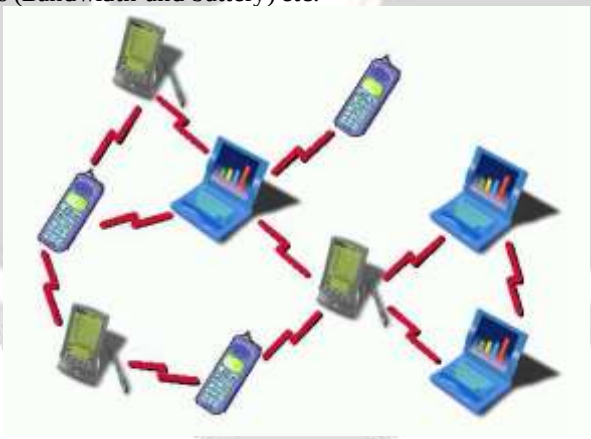

Fig 1. Mobile Ad hoc Network

Power consumption is one of the critical challenging issues in ad hoc network. In MANET, mobile nodes are constrained by the limited battery power for their operation. Hence the battery power of the node is a precious resource that must be used efficiently in the network.

In this paper II part is literature survey and related work ,III part is proposed solutions and IV part is simulation environment and V is conclusion.

II. LITERATURE SURVEY AND RELATED WORK

A. Types of Routing Protocol

Due to a dynamic nature of nodes, Routing is a challenging task in a MANET. Every node acts as a router to find optimal path between source and destination for data transmission in the network. Routing protocols may be classified in three categories:

1. Reactive Routing Protocols

2. Proactive Routing Protocols
3. Hybrid Routing Protocols

1. Reactive Routing Protocols

It is also known as on demand routing protocol. These protocols do not maintain routing information. In on demand, if a node wants to send data packets to another node, then it send RREQ packet to destination. For example: AODV, DSR, TORA, ABR etc.

2. Proactive Routing Protocols

It is also known as table driven protocol which maintains routing information even before it is needed. Each and every node in the network maintains routing information to every other node in the network. Routes information generally in the form of routing table and periodically updated network topology changes. For example: DSDV, WRP, CGSR etc.

3. Hybrid Routing Protocols

Hybrid routing protocol is a combination of features of Reactive and Proactive routing protocol. It is a zone based routing protocol. For example: ZRP etc.

B. Ad hoc On-demand Distance Vector Routing (AODV)

Ad-hoc on demand Distance Vector Routing (AODV) is a reactive routing protocol. Unlike the DSR which uses source routing where as AODV uses hop-by-hop routing concept. It is based on two important phenomena Route Discovery and Route Maintenance.

Route Discovery

When a source node wants to send a message to some destination, and doesn't a valid route to the destination, so it initiates a route discovery process. It broadcasts a route request (RREQ) control packet to its neighbors, which then forwards to their neighbors, and so on. AODV protocol utilizes destination sequence numbers to ensure that all routes has fresh route information.

During the forwarding process the RREQ intermediate nodes record the address of the neighbor from which the first copy of the broadcast packet is received in their route tables, thereby establishing a reverse path. Once the RREQ reaches the destination or an intermediate node with a fresh enough route, the destination or the intermediate node responds by a route reply (RREP) control packet back to the neighbor from which first received the RREQ.

Route Maintenance

When a intermediate node moves or links between two nodes are break or fail a node adjacent to break node generate a RRER message and sends this message to source node to inform about link failure . This process continues until the source node is reached .AODV also supports periodic HELLO messages to detect link failures. A node can keeps track of its Neighbors by getting a HELLO message that each node broadcast at set intervals.

C. RELATED WORK OF ENERGY EFFICIENT ROUTING PROTOCOL

The paper[1] Ranjan Kumar proposed Route Stability and Energy Aware based RSEA-AODV routing protocol which based on route stability. This RESA-AODV selects route according to signal strength, delay, total remaining energy, and draining rate of nodes. All this parameters are compared with predefined threshold, if calculated value satisfy the threshold condition then it process the route request packet otherwise it drops the packet.

The paper[4] Hemant Dandotiya et al. proposed method which works in two phase; first is signal strength based AODV and second is like normal AODV. In the signal strength based AODV, first calculate signal strength between nodes then compare it with RSSI threshold values. If it is greater than RSSI threshold then it is accepted for further processing otherwise discarded it. On the basis of signal strength, if there is no route found to destination then node sends RREQ again to its neighbor node. Node check if RREQ retry is greater than Retry threshold (RET) then it switch to normal AODV and find the route on the basis of minimum hop count.

The paper[2] G.Rajkumar proposed SaP(short alternate path) protocol which works based on link break or path failure. This protocol transfers the data from the failed node and delivers it to the node next of the failed node in the route. Thus this protocol doesn't go in search of alternate path or start new route discovery process. Thus after discovering this node it transmits the packets to the destination without changing the route.

In the paper[3] Dr. Annapurna P Patil et al. proposed Energy Efficient AODV (IEE_AODV) routing protocol which is based on energy efficiency and drain count. This protocol select path which have least drain count. In case if there are two or more path have same drain count value then path which have least hop count is selected. If two or more path have same hop count then the path containing nodes with least transmission power is chosen. So this helps in obtaining longer network lifetime.

The paper [5] Shital Patel used the concept of Cross Layer Design which provides interaction between physical layer and network layer. In this paper proposed technique which use Received Signal Strength (RSS) information and Signal to Interference and Noise Ratio (SINR) of received message to choose reliable and noise free links to decide which route is best in the route discovery process. This technique selects only those nodes which are in the transmission range of each other in the network and higher SINR value than Threshold SINR at network layer. The Best value of RSS and SINR is chosen to find the route which is more stable and noise free than all other routes in the whole network.
In the paper [6] Prabhdeep Singh proposed Intelligent AODV (IAODV) which select route on the basis of speed of intermediate nodes means this protocol used RSSI values to find a route between source and destination. In this proposed mechanism, the nodes moving with minimum speed are selected to route data from source to the destination.

III PROPOSED SOLUTION

In this paper we proposed new method which is based on the route stability means it find route which is stable and energy efficient as compare to existing routing protocol.
When the source node has data packets to send at the destination node then first of all it checks its routing table. If there is no available route found then it starts route discovery process by simply send route request RREQ packets to its neighbors. RREQ packets arrival at the neighbor node the first checks its RSSI value and its bandwidth. If the node which has greater values of RSSI and bandwidth as compare to threshold value then it processed otherwise discard this RREQ packets. Also we taken a min_energy of every node and at destination we take max energy of all paths and send RREP packet back to source node. For example, consider the following scenario, which have two paths. In the first path there are three nodes with energy value 35, 48, 57, 90 respectively and second path with energy value 25, 36, 58, 100 respectively. The minimum energy of first path is 35 and second path is 25. So we choose first path because of its have higher minimum energy among two paths. In the fig 2. Cleary show that the working process of our proposed work.

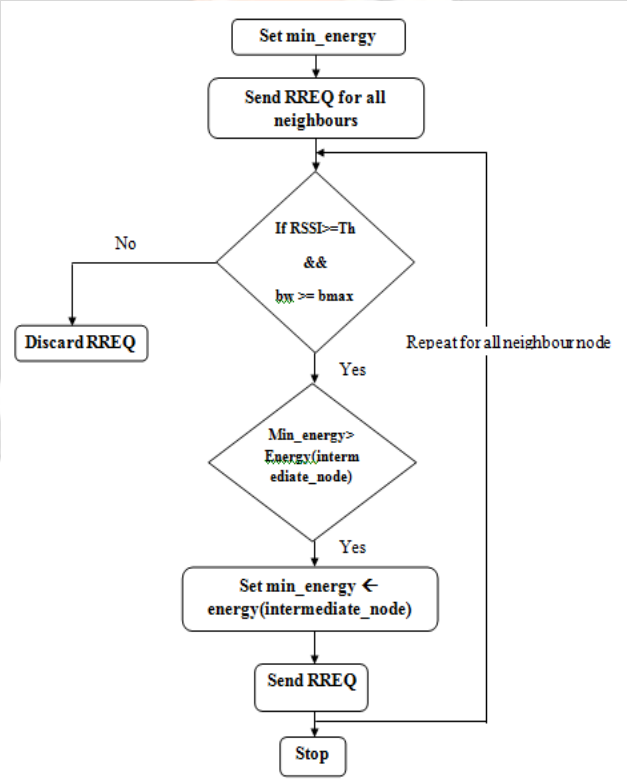

Figure 2: flow diagram of proposed algorithm

IV SIMULATION ENVIRONMENT

Simulation parameters are shown in Table1.Simulation is done using NS2(Network Simulator). NS2 is an object oriented simulator, written in C++, with a Tcl interpreter as a front end. It supports large number of network protocols for simulation and provides results for wired, wireless and wired-cum-wireless scenarios, targeting at simulation research.

Table 1:Simulation Parameters

Parameters	Value
Simulation Time	100 sec.
Simulation area	600*600m
No. of mobile nodes	10/20/30/40/50
Routing protocols used	AODV
Traffic type	TCP
Initial energy	100 joules
Tx Power	5.0 w
Rx Power	1.0w
Propagation Model	Two Ray Propagation Model

Performance Metrics:

***1. Average End-to-End Delay*:**

End-to-End delay indicates time taken for a packet travel from source to destination.

2. Average Remaining Energy:

Average remaining energy is defined as the ratio of sum total of remaining energy of all nodes in the network at the end of simulation to the total number of nodes.

The comparative analysis of proposed method and existing AODV has been done under varying simulation environment using NS-2 [11] simulator. We take 10,20,30,40,50 nodes for Simulation. Other simulation parameters are given in Table
The results are shown to state that energy-efficient AODV outperforms than AODV. Figure 3. Shows a average end-to-end delay as for node 20 and 30 graph same but as node increases delay also increases.

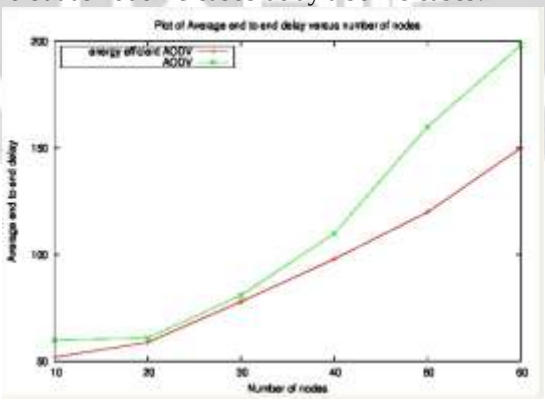

Fig.3 Average end-to-end delay

Figure 4 shows a remaining energy of node, in this graph shows that proposed AODV has more remaining energy at the end of simulation, and perform better than existing AODV.

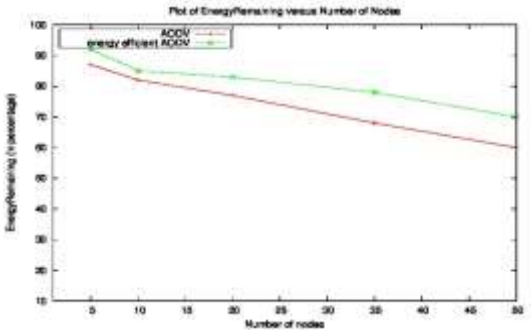

Fig.4 remaining energy of node

V CONCLUSION

MANET is a collection of mobile nodes which are limited battery operated. Energy consumption is critical issue in MANET. In this paper we evaluate the energy efficiency of existing well known AODV routing protocol. We propose mechanism which provides energy efficient algorithm for AODV routing protocol. This approach will Increase network lifetime by using optimal path which consist of stable energy level of node.

In this mechanism we take RSSI(Received Signal strength) ,minimum bandwidth and min energy of a node and compare RSSI with a threshold value. And if RSSI is greater than a threshold value then send a RREQ packet to other nodes, otherwise discard packet. So we prolong the network lifetime. And propose AODV perform better than existing AODV.

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