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Energy efficient routing in MANET

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Abstract *- The energy consumption in wireless nodes depends on transmission power and reception power. The lifetime of a network can be increased by reducing the transmission power and reception power consumed by wireless nodes. This paper proposes two solutions to transmission of packets using AODV protocol. The first solution reduces the transmission power and reception power of a node using AODV protocol. The second solution includes a hybrid technique for distribution of power to each node and also by reducing the power consumed by each node. It also involves a procedure where before transmitting a packet to the next hop the transmission energy of that hop is checked, if it is high the packet is not transmitted a stored in the queue, later the source node begins the route discovery process to find new path.*

Keywords *- MANET, forwarding, energy consumption*

I. INTRODUCTION

Mobile Ad-Hoc network is a collection of mobile nodes that interact with each using multi hops or through direct wireless links. The nodes in the dynamic distributed system are mobile as the nodes are not dependent of each other. MANET is a network with no infrastructure or centralised access point. Ad hoc network have characteristics like lower latency of nodes, self-organisation, self-managing, limited resources and so on. It can be deployed on various fields such as battlefields, home area, and personal area network. An ad-hoc network cannot be line-powered but batteries are primary sources for them. The main objective of these studies is energy consumption in order to increase the life time of the ad-hoc network. The ad-hoc routing protocols use flooding mechanism for route discovery and route maintenance. The simplest technique to flood is called simple or pure flooding. The nodes are battery powered, energy saving is an significant problem in the MANET. For Manets optimization of energy consumption has greater impact as it directly affects the life time of networks. Power consumption is directly proportional to route length while forwarding the packet in ad-hoc network.

When the route length is increased power consumption is also increased. Each node consumes battery power for transmitting and receiving a data packet. The more node transmits or receives a data packet the more is data consumption due to the limited energy of MANETS energy conservation becomes an important challenge in MANET.

II. LITERATURE SURVEY

A **MANET** is characterised as a unique continuously self-configuring, infrastructure-less, decentralized, multi-hop, limited resources network of mobile devices connected wirelessly. In mobile ad hoc network nodes are mobile, therefore the topology of a network may change quickly and unpredictably change and power is considered to be an important resource as it is limited. Routing paths in MANET has multiple hop since the nodes have limited transmission range and some of them cannot communicate directly with each other. Each node in the ad hoc network acts like a router

Yi-Cheng Huang, Sheng-Yan Chuang and Sheng-De Wang presented a paper on "A Dynamic node degree management scheme for energy efficiency routing protocol in wireless ad hoc network". They explained a mechanism to address the problem of transmission collision which affected the saving of energy and hence help extend the network lifetime. Their mechanism was based on Relative Neighbourhood Graph (RNG) which selects/decides the transmission range based on the degree of the node. [1]

Neeraj Tantubay, Dinesh Ratan Gautam and Mukesh Kumar Dhariwal presented a paper on "A review of power conservation in wireless Mobile Adhoc Network (MANET)". This paper gives information of the network which is wireless and hence the nodes operate on battery power and battery energy. Thus power saving becomes a crucial task as the energy resources are limited at the nodes. Nodes with less energy create problems in communication activities in the network. This paper gives various power saving techniques to control power consumption. They say power consumption can be controlled at different levels such as device level, transmission level or using routing protocols that are aware of power. [2]

Ashwin G. Raiyani and Prof. Anit M Lathigara presented a paper on "Probabilistic and neighbour knowledge based flooding mechanism for Ad hoc On Demand Distance Vector (AODV)". They say that flooding is the basic and supreme routing operation in MANET. Under flooding each node sends an HELLO packet to all its in-between nodes until the message is known to all the nodes in the network. The performance of the network decreases when the flooding becomes inefficient due to node coverage density which increases control overhead in wireless network. The proposed algorithms in this paper are efficient for route discovery, forwarding node probability and node coverage area. This approach works better when matched to AODV routing protocol in terms of packet delivery, throughput, end to end delay.[3]

III. PROBLEM DEFINITION

In mobile Ad-hoc network the mobile nodes are connected to other mobile nodes. There is energy consumption in transmitting and receiving the data packet between nodes. The total energy consumed depends on the following states of the system

1. TRANSMISSION STATE
2. RECEPTION STATE
3. IDLE STATE
4. OVERHEARING MODE

In order to prolong the life of network power consumption must be reduced by entering into sleeping mode when it is idle in order to extend the life of the mobile host.

A. Transmission Mode

The energy required for transmitting the data packet from one node to other is called transmission energy (Tx) where the transmission energy (Tx) depends on size of data packet. The size of the packet is directly proportional to the transmission energy.

B. Reception Mode

The energy consumed to receive a packet is called reception energy (Rx) and when node receives a data packet then it is said to be in reception mode.

C. Idle Mode

When the nodes have to adhere to the wireless medium continuously in order to detect a packet that it should receive, so that it switches from idle mode to reception mode, the node is neither transmitting nor receiving any data packets however this mode consumes power.

D. Overhearing Mode

When a node receives unwanted packets it is said to be in overhearing mode .Receiving such irrelevant packets increases the energy consumption. A node when it is in the active mode spends more amount of energy. Therefore, our main aim is to minimize the energy by decreasing the frequency of the collision when transmission takes place in each node. The packet collisions occur when no collision avoiding mechanisms are used. The nodes with minimal number of neighbour nodes have fewer chances of packet collision when compared to the nodes with higher neighbour node. At least two retransmissions are required by each collision thereby increasing the energy consumption when the collision rate is high The collision problem affects the power consumption to a greater extent. Our objective is to increase the lifetime of network amidst maintaining the connectivity of the entire network.

IV. PROBLEM SOLUTION

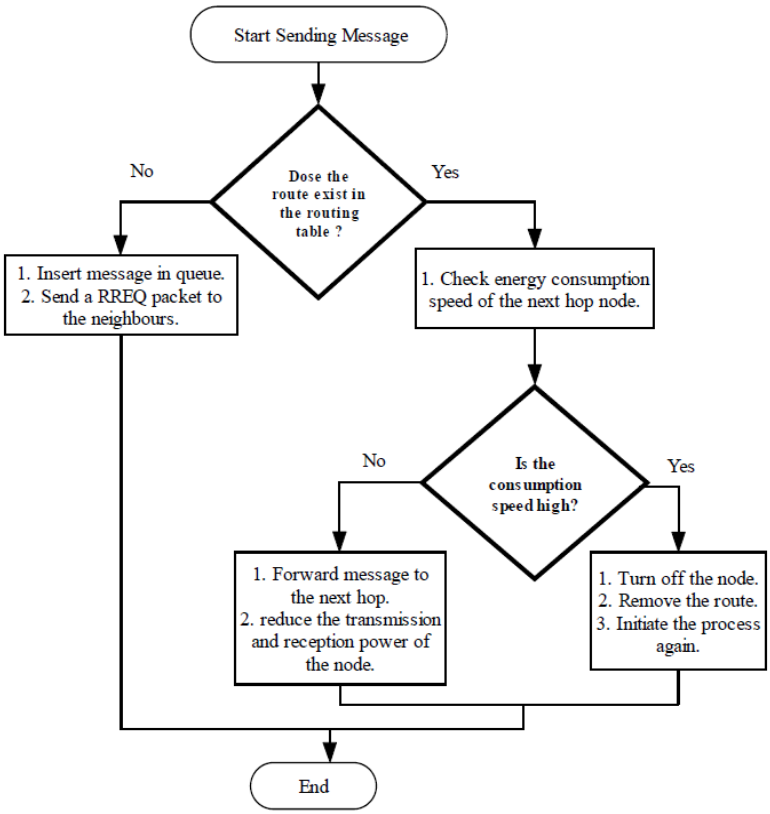
We describe two solutions for the transmission of packets using the AODV protocol. The first solution includes reducing the transmission power and reception power of the nodes using AODV protocol. The second solution includes a hybrid technique for distribution of power to each node and also by reducing the power consumed by each node. In order to carry out these implementations we have to follow these steps

1. The routing table of each wireless node is checked before forwarding any packet. The routing table is checked in order to determine if the corresponding route is available in the routing table, if not the packet will be stored in the queue and the source node sends a RREQ packets to its neighbours for path discovery.

2. $$Pt = ptInit * \frac{RemEng}{InitEng} \quad ; \quad Pr = PrInit * \frac{RemEng}{InitEng}$$

Pt: Transmission power
Pr: Reception power
PrInit: Initial reception power
RemEng: Remaining energy of nodes
InitEng: Initial energy of node

The transmission power and reception power of the nodes can be reduced by using the above two formulae and also the node must be able to forward the packet over a minimum distance with the minimum power to reach the next neighbour.



3. A procedure is carried out before transmitting the packet to the next hop, this procedure checks the amount of energy consumed by the next hop. If the energy consumed by it is high, the packet will not be forwarded and the route will be removed from the routing table. Once the route has been removed from the table, source node again begins the route discovery process to find the new path. If the procedure discovers that the power consumed by the next hop is less, the packet will be forwarded to it followed by reducing the transmission power and reception power.

V. CONCLUSION

Even though energy can be conserved at devise level, at transmission level or by using power aware routing protocol. Our study highlights conventionally AODV protocol where energy will be conserved at transmission and reception mode .which helps in achieving objective to maximize reachability and enhance the life of the network. Compared to previous studies done on Relative Neighbour graph. Where range can be determined by RNG may result in asymmetric link problem.

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