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An Efficient Topology Control Mechanism for Enhanced Network Connectivity and Routing In Manets

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***Abstract*: In MANET, energy consumption and network connectivity are considered as the two very important issues. Due to the mobility of the nodes, the network partition occurs in regular manner. To avoid this, several researches concentrated on this issue. But still there is not proper solution provided for this issue. In this work, we developed topology control algorithms, which are constructed to attain both network connectivity and energy consumption. It consists of three main parts. Network and Interference model is introduced to make sure the network connectivity. Energy based topology control is developed to ensure more energy efficiency. Here the power consumption is also determined and validated in each and every route. Energy level of node is equally maintained in both route discovery and route maintenance phase. Packet format of specified technique is proposed which consists of power consumption and link availability. we have proposed the dynamic algorithm to disconnect the node with low energy by predicting the expiration time of a link of node which is connected to other nodes with minimum no. of k edges and results to get more reliable, connected network. In order to ensure the proper forwarder node selection, we implement FAF based technique. By using the extensive simulation results using Network Simulator (NS2), the proposed scheme EETCA achieves better network lifetime, packet delivery ratio, less overhead and end to end delay than the existing schemes like NCTC and DM.**

***Keywords*— MANETs, topology control, reliability, k-edge connectivity, link expiration, network lifetime, packet delivery ratio, end to end delay, overhead.**

I. INTRODUCTION

A. Mobile Ad Hoc Networks (MANET)

Mobile ad-hoc network is an independent system of mobile nodes connected by wireless links forming a short, live, on-thefly network even when access to the Internet is unavailable. Nodes in MANETs generally operate on low power battery devices. These nodes can function both as hosts and as routers. As a host, nodes function as a source and destination in the network and as a router, nodes act as intermediate bridges between the source and the destination giving store-and-forward services to all the neighbouring nodes in the network. Easy deployment, speed of development, and decreased dependency on the infrastructure are the main reasons to use ad-hoc network.

B. The topology control problem in MANET

In mobile ad hoc wireless communication, each node of the network has a potential of varying the topology through the adjustment of its power transmission in relation to other nodes in the neighbourhood. In contrast, wired networks have fixed established pre-configured infrastructure with centralized network management system structure in place. Therefore, the fundamental reason for the topology control scheme in MANET is to provide a control mechanism that maintains the network connectivity and performance optimization by prolonging network lifetime and maximizing network throughput.

Topology control is a technique used to control transmission range/power according to the network topology. The topology in a MANET is controllable by adjusting some parameters such as the transmission power, channel assignment, node degree and transmission range. It is such a scheme to determine where to deploy the links and how the links work in wireless networks to form a good network topology, which optimize the energy consumption, the capacity of the network, or end-to-end routing performance. It is developed to reduce energy consumption and node interference. It results in a simpler network topology with small node degree and short transmission radius, which have high quality links and less contention. Topology control broadcasts efficiently, i.e. each node transmits packets using low power to prevent interferences and to reduce energy consumption [2]. This paper proposes an algorithm which connects the nodes with minimum no. of k edges and predicts the time expiration of a link by calculating the remaining energy of nodes to form the more robust network and reliable topology construction.

A MANET topology can depend on uncontrollable factors such as node mobility, weather, interference, noise as well as controllable factors such as transmission power, directional antennas and multi-channel communications. A bad topology can impact negatively on the network capacity by limiting spatial reuse capability of the communication channel and also can greatly undermine the robustness of the network. Network capacity means that the bandwidth and ability for it to be used for communication. A network partitioning can occur in a situation where the network topology becomes too sparse. Similarly, a network which is too dense is prone to interference at the medium access (MAC) layer, the physical layer of the network. So the network should neither be too dense nor too sparse for efficient communication amongst nodes to take place.

C. Problem Definition

The problem identified in contemporary research literature pertaining to topology control in MANET is that most of the topology control algorithms do not achieve reliable and guaranteed network connectivity.

II. RELATED WORK

Dalu et.al [1] proposed topology control algorithm to maintain the topology without any control message. If any node goes out of range, communication would not get affected. The communication range is higher than the maximum allowable distance. The algorithm controls the movement of node with respect to a target node to make more connectivity of the network through the topology maintenance. Here there is no need to change routing table as the connectivity o the network is maintained throughout the communication phase.

Manvi and Hurakadli [2] proposed agent based model to address the aspect of topology discovery and routing. In this model, three agents are used. Manager Agent handles the activities of route discovery and routing agency. Monitoring Agent is deployed to monitor resources like transmit power, battery life, bandwidth and reliability. Discovery and Routing Agents discover the links between the mobile nodes, perform routing information fusion and build pre-computed paths.

S.Muthuramalingam and R.Rajaram, [3] proposed clustering algorithm which reduces the number of clusters and optimize the load balancing factor. Network lifetime is also improved. This algorithm does topology management by the usage of coverage area of each node and power management based on mean transmission power within the context of wireless ad-hoc networks. By reducing the transmission range of the nodes, energy consumed by each node is decreased and topology is formed.

Ngo duc Thuan et.al [4] proposed Local Tree based Reliable Topology to update the effects on network connectivity. It preserves edge connectivity which is more reliable. This scheme considered to be the scalable and applicable scheme that is used in MANET. By experimental results, the proposed topology achieves high transmission range and more network connectivity than that of existing scheme.

Fujian Qin [5] proposed algorithm to construct topology that can meet the QoS requirements and decrease the total transmission power in the network. At physical layer, it is adopted that cooperative communication which combines partial signals to obtain completer information. At network layer, the whole topology information can be collected when it is not required to perform packet forwarding. Energy Efficient Topology Control and QoS formulation are proposed to achieve more network connectivity.

Bharathi and Saranya [6] proposed secure adaptive distributed control algorithm which aims at topology control and performs secure self organization. It consists of four phases like Anti node detection, Cluster formation, Key distribution and key renewal. In anti node detection, both encryption and decryption is performed to find the anti node. In cluster formation, cluster head is selected to ensure more information about network. Both key distribution and key renewal phase are developed to provide more integrity of data.

Jie Wu and Fei Dai [7] proposed mobility sensitive topology control method that consists of local view consistency based on synchronous and asynchronous method. A local view consists of locations of 1-hop neighbors within a normal transmission range. It is collected via exchanging “Hello”

messages among neighbors and used to select logical neighbors at each node. The weak consistency is introduced to reduce the maintenance cost without any synchronization among neighbours.

Karunakaran and Thangaraj [8] proposed topology control algorithm based on power level. In this technique, topology control is maintained within each cluster. Initially, the clusterhead is selected based on factors power level, stability and connectivity. After the cluster-head selection, the connectivity of each node of the cluster with the cluster-head is checked. If the connectivity is low then the connectivity is increased by increasing the power level. In a cluster, cluster-head which is incharge of a dense area will experience low inter node interference. If there are any unidirectional links in the network then the cluster-head will form bidirectional link with it. If there are no unidirectional links, then the cluster-head will start linking up with the nodes that are not its direct neighbors. If the connectivity is higher than a threshold, then the cluster-head reduces the power level.

III. PROPOSED SYSTEM

The proposed system has the following operational modules.

Modules:

1. Mobile ad-hoc network creation and analysis of topology connectivity

In this module, a Mobile ad-hoc network is created. All the nodes are configured and randomly deployed in the network area. Since our network is a mobile ad-hoc network, nodes are assigned with high mobility (movement). A sample routing is performed to check the connectivity in the network. The network connectivity is analyzed between the nodes.

2. Performance analysis

In this module, the performance of the routing process is analyzed. Based on the analyzed results X-graphs are plotted. Throughput, delay, energy consumption are the basic parameters considered here and X-graphs are plotted for these parameters.

3. Implementation of Topology control mechanism

In this module, a topology control mechanism is used. The proposed method is a dynamic method for multi edge connected algorithm which determines the no. of edges i.e. value of edge is k for each local graph based on local

movements while maintaining the required connectivity. It analyses the relationship between network connectivity and value of k related to the node moving speed, calculates the probability that a node moves out of the transmission range of another node.

4. Performance analysis and Result Comparison, Conclusion

In this module, the performance of the proposed method is analyzed. Based on the analyzed results X-graphs are plotted. Throughput, delay, energy consumption are the basic parameters considered here and X-graphs are plotted for these parameters.

Finally, the results obtained from this module is compared with third module results and comparison X-graphs are plotted. Form the comparison result, final RESULT is concluded.

Enhancement Module:

1. In order to ensure the proper forwarder node selection, we implement FAF based technique. The routing process is:
2. Determine forward transmission area (FTA) all of the possible next-hop nodes of node.
3. Determine the next-hop for each possible next-hop nodes and find the distance between the next-hop nodes and base station (SFTA).
4. Calculate forward energy density (FED) of each possible next-hop node.
5. Calculate the weight of edges between each node.
6. Calculate the forward aware factor (FAF) of each possible transmit link using FED + the weight of edges.
7. Choose the next-hop node which has maximum FAF.

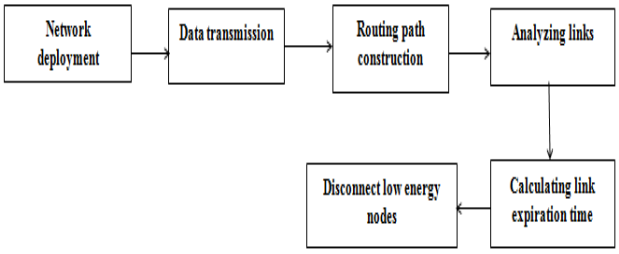

Fig.1 Block diagram of Proposed System

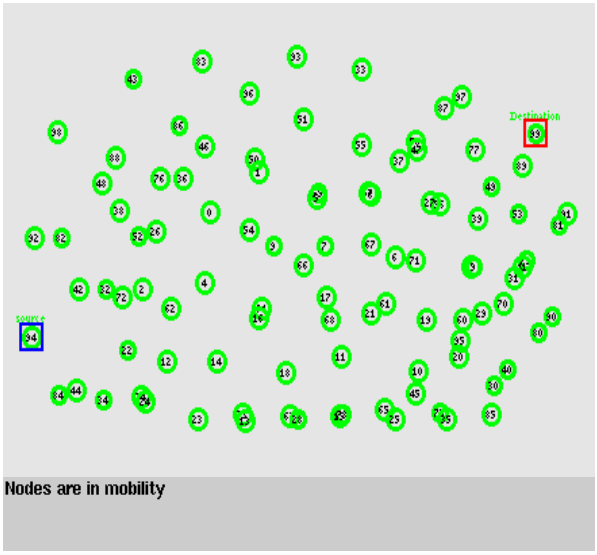

Fig.2 Network Creation

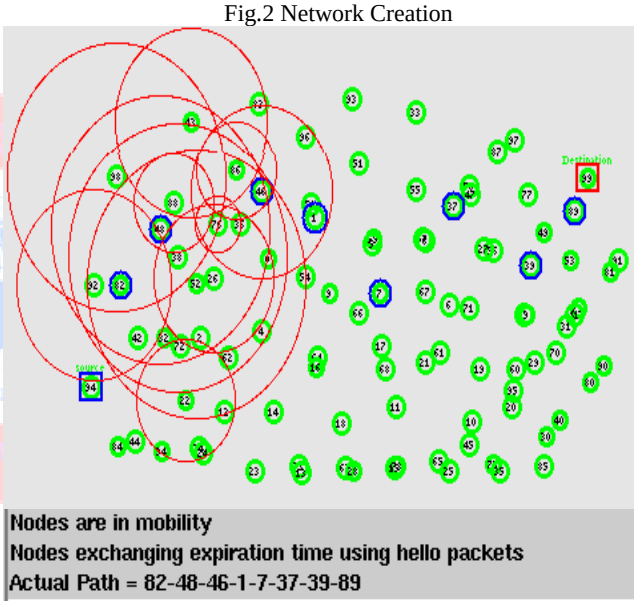

Fig.3 Path Formation

IV. RESULTS AND DISCUSSION

After implementing the proposed system using NS2 tool, the results obtained are as follows:

Fig.4 Throughput Comparison graph

Figure 2 shows the network formation stage, where topology of network can be able to see, and also nodes are identified as source and destination. Here nodes are having mobility.

Here after formation of network nodes present over the network share the details like expiration time of the link by making use of hello packets. After this process, actual path is going to be formed as shown in figure 3. The intermediate nodes are highlighted here.

Next in performance evaluation stage, graphs are arranged to show the performance results.
Figure 5 shows the throughput comparison graph, where it shows the proposed is better(throughput is high) as compared to existing system.

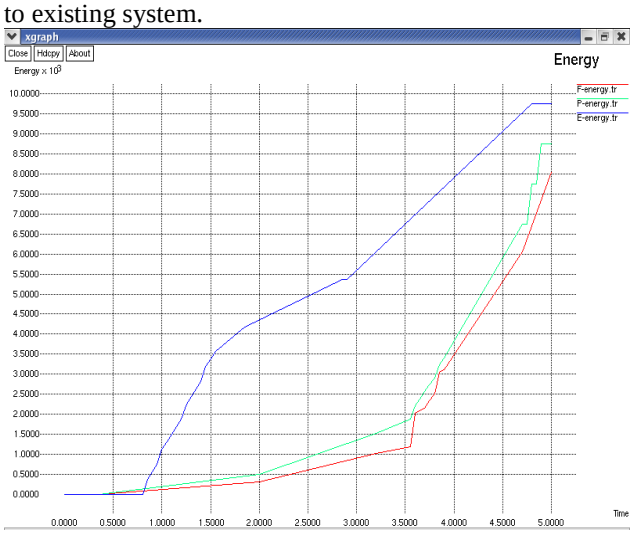

Fig.5 Energy Consumption graph

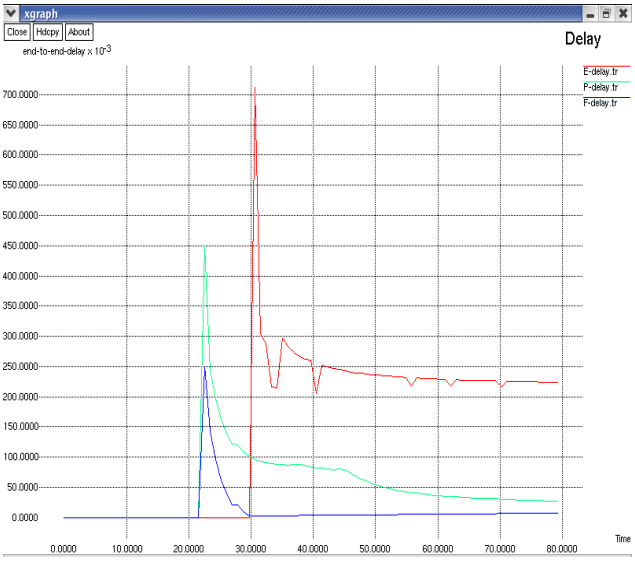

Fig.6 Delay comparison graph

Figure 5 shows the energy consumption graph, where it shows that proposed system is going to consume less energy.

Figure 6 shows the delay comparison graph. The proposed system has less transmission delay and hence its performance is better.

V. CONCLUSIONS

The influence of mobility is on topology control in MANET. The dynamic topology control method focus on dynamic method for k-edge connected algorithm that appropriately choose the value of k based on the local movements on the nodes. Achieving the reliable transmission using topology control in MANET is possible only using the k- edge connected algorithms and selecting more number of edges i.e. k edges for each node in a local graph. To detect the link expiration, checks the remaining energy of a node and predicts the link expiration time. In order to ensure the proper forwarder node selection, we implemented FAF based technique. So the proposed method constructs more reliable topology and gain more connectivity of the network by selecting the path with energy stability node and less complex network with minimum number of edges connected to each node.

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