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MODIFICATION OF TIME SEQUENCE STRUCTURE ALGORITHM FOR EFFICIENT AND EMERGENCY MESSAGE DISSEMINATION FROM SOURCE TO DESTINATION IN WIRELESS AD-HOC NETWORKS

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ABSTRACT

Broadcasting is a method of transferring a message by a source node to all other nodes simultaneously, especially in highly dynamic networks. So there is hive of activities performed by the system and there arise lots of problem regarding the transmission. One of the main issue that faced in wireless adhoc networks is mobility of nodes. To know the global information about the topology of such network is difficult. The modified time sequence structure algorithm works even in highly dynamic and dense networks. It provides maximum coverage of broadcasting message fastly by choosing the optimal path. It also minimize the number of transmission required to disseminate emergency message from source to intended destination in a situations like disaster, crisis etc in wireless adhoc networks.

I. INTRODUCTION

Adhoc network is an infrastructure less network. When comes to wirless adhoc network, group of mobile nodes that forms a impermanent adhoc network without any predefined infrastructure. The characteristics of these networks such as highly dynamic topology, decentralised infrastructure, limited resources security causes routing problems [1]. The wireless adhoc networks with mobile nodes are generally used for the communication when crisis, disasters happens. It also used in sensor networks and personal area network, as well as meetings, conferences and traffic systems etc.

Wireless adhoc networks

Mobile adhoc networks are characterized by a dynamic topology and usually deployed in a antagonistic environment with small number of resources. The nodes in the networks are more endangered and are often lead to collapse. Mobile adhoc networks are networks that are built in an adhoc manner by the collection of interacting devices with wireless communication capabilities[2]. The word adhoc comes from Latin. An adhoc network is short term network connections made to the communication purpose. The networks are for longer period connections then it be like a normal old network connections. The wireless adhoc networks deployed in 1990s and researched for many years. The wireless adhoc networks are group of two or more wireless communications devices or nodes. These wireless nodes can able to communicate with other nodes in the network within their communication range or one that is outside of their communication range. The heterogeneous nodes forming the short term networks.

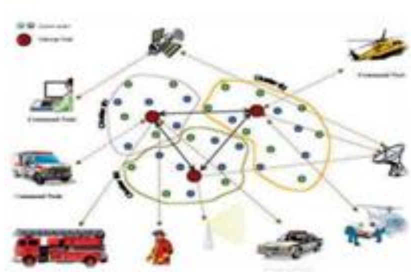

Fig. 1. Infrastructure of wireless adhoc network

without the support of any centralized administrator. In such environment, it may be necessary for one wireless host to enrol the support of other hosts in forwarding a message to its destination node, because of the restricted range of each wireless host's transmission.

Broadcasting:
The broadcasting is a method of disseminate a message by a source node to all other nodes in the network simultaneously. Broadcasting is a common operation in a network. In a mobile adhoc network broadcasting is performed more than ones due to the mobility of nodes. Flooding is the normal way of doing broadcasting but the direct forwarding of message very costly and lead to the problems like redundancy, con-tention, and collision, to which refer as the broadcast storm problem[3]. The mobile networks is formed spontaneously. So, any mobile node can initiate a broadcast activity at any time. Due to host mobility to know the global information is difficult. In direct flooding every the message received node

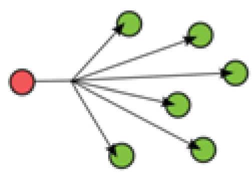

Fig. 2. Broadcasting operation

has the responsibility to rebroadcast the message, after getting the broadcast message for the first time. It redundancy of rebroadcasts message and contention. After a mobile node broadcasts a message, then some times these transmissions may grievously contend with each other may lead to contention because of many of its neighboring node decide to rebroadcast the message.

II. RELATED WORK

Self pruning method:
In wireless adhoc networks, the local broadcasting algorithms mainly focuses on reducing number of transmissions. It uses self pruning method [4] with dynamic approach. In dynamic approach, the current state of the node is determined by considering the local topology and information about the broadcast state. Flooding cause multiple copies of packets at the destination. To avoid this selective flooding is used. In which the node forward only in correct direction. Every nodes keep its neighboring node information by one hop or two hop. By self pruning, each node can determine whether forward or not. If a node has to do broadcast, then it is selected to be as a forwarded node. This decision made by self pruning is known as coverage condition. The advantage is, it reduce number rebroadcasting and collisions. But it is not extended to get the position information.

Flooding method:
Flooding is a broadcasting method of transferring message directly towards all nodes in a network. Source node broadcasting a message to all of its neighboring nodes directly. Each and every node rebroadcast the message exactly once upto that all nodes in the network received the message. This flooding way of broadcasting algorithm increase the power gain, lead to redundancy and congestion in the network. The chances of signal collision is very high when all nodes spread the message in the network same time. It lead to more number of retransmissions or message drop[18]

Probablistic method:
The Probabilistic method of broadcasting is similar to flooding method because every node in the network rebroadcast the message. But there is difference is that, the rebroadcasting of the message is based predetermined probability. In a high density network, multiple number of nodes coming under the same transmission coverage area. It will protect nodes and resources without affecting the reliability. Due to very small

shared coverage area in case of sparse structured networks, nodes won't receive the message with in that predetermined probability. High probability is required to achieving full coverage in such networks. [18]

Counter Based Method:
The counter based method of broadcasting describes the connection between the number of times a message is received at a node in a network and the probability of that node required to stretch out extra area on a rebroadcast. Based on reception of a early unseen message, the node starts a counter with a value of one and sets a RAD. According to each redundant message received during the RAD, the counter is incremented by one. When the RAD is expires, suppose the counter value reaches to below a particular threshold value then the message will be rebroadcast again or else it is simply dropped the message.[20].

Area baased method:
M.Heissenbuttel et al. in[11] It is a simple broadcasting protocol. In area based method not need to the neighbor node information earlier not need transmission control messages. It uses the concepts of dynamic forwarding delay. One of the main advantages is that, it will not be suffering with dynamic topological changes caused by node mobility in networks. It does not cause any route overhead and it is highly scalable in dynamic network. In DDB the current position information will be store the packet header of last broadcasting node. The main merit of this method is that to decide when and where to broadcast, it required only external information by other nodes. The area based method minimize the number of transmission and improves the reliability of the packet delivery to all nodes simultaneously.

Gossip method:
Zygmunt J. Haas.[9] authors proposes gossip based adhoc routing. Gossip method minimize the routing overheads protocols. The nodes will forward the message with some probability. Gossiping method unveils bimodal behaviour in moderately larger networks. But in some circumstances the gossiping is dies expeditiously. There the message will be loss. In the rest of executions, a considerable portion of the nodes gets the message. This is based on the gossiping probability and the topology of the network.

III. MODIFIED TIME SEQUENCE STRUCTRE ALGORITHM

The TSS, time Sequence Scheme is an efficient broadcasting algorithm especially for dynamic networking environments. The algorithm provide solution to broadcasting problems by providing an optimal path. TSS algorithm works according to a time slot. Each nodes have their own time slot for transmission. Hence, it minimize the overall number of rebroadcasts required in network. TSS algorithm does not require position information of nodes, because it only uses one hop information. It is considered as residual coverage of nodes. By analysing this residual value, which nodes has larger value it will transmit first in early time slot T[13]

Input:*ul*
Output:The ordered vectors collection T=$T_{ul}, T_{ul-1}, ... T_1$
Algorithm A:
1. $T \leftarrow \varphi$
2. $upp \leftarrow ul$
3. $midd \leftarrow ul$
4. $low \leftarrow ul$
5. $T_1 \leftarrow (upp, midd, low)$
6. $T \leftarrow T_1$
7. while *midd* > 1 do
8. if *midd* == *low*
9. *low*← *low-1*
10. *midd*← *upp*
11. else
12. if *midd* >*low*
13. *midd*← *midd-1*

14. $T_{nex} \leftarrow (upp, midd, low)$
15. $T \leftarrow T \cup T_{nex}$ [13]

B. Each node in the network runs Algorithm A and generates sequence of time-slots T
C. Source node initiates the transmission of message msg, and covers all of its one hop neighbors.
D. A nodes who receives the message then it considered as covered node and other nodes are uncovered ones.
E. A node marked as covered by itself, after receiving the message msg and also it calculate the residual coverage, ResCov of that node.

F. Algorithm B indicate node self scheduling. According to algorithm B, nodes will schedule themselves for following transmission in the time slot of T_{bd}.
G. After a node scheduled to transmit the message, msg in a time-slot of T_{bd}, the node calculates the residual coverage at the beginning of time slot.

H. If the value of residual coverage of a node has decreased even in the time slot in which node has scheduled itself for the transmission, then the node re execute the Algorithm B and schedules itself for a fresh, next transmission time slot.

I. Suppose in a time slot T_{bd} there is more than one neighboring nodes are scheduled, then the largest residual coverage valued node transmits in that scheduled time slot T_{bd} The other nodes which is left there in network, will transmit the message in the next time slot.

Input:*ResCov(node)*;
$^{T}currenttime^{=(^{u}currenttime,\ ^{m}currenttime,\ ^{l}currenttime)}$
Output:time slot $T_{bd} \leftrightarrow t_{bd}$
Algorithm B:

- *rescov* ← *ResCov(node)*
- $^{upp} \leftarrow {}^{u}currenttime$
- $^{midd} \leftarrow {}^{m}currenttime$
- $^{low} \leftarrow {}^{l}currenttime$
- if *rescov* > 1 *midd*
- $^{T}bd \leftarrow {}^{T}currenttime^{+1}$
- else
- if *rescov* ≤ *midd and rescov* ≥ *low*
- if $^{T}currenttime^{(^{u}currenttime,\ ^{m}currenttime,\ ^{l}ct)} \leftarrow$ is

edge slot

- if *low*> 1

- $T_{bd} \leftarrow (upp, rescov, low-1)$
- else
- $T_{bd} \leftarrow (upp, rescov, 1)$
- else
- $T_{bd} \leftarrow (upp, rescov, low)$
- else
- if *rescov*≤ *low and rescov > 1*

- $T_{bd} \leftarrow (upp, rescov, rescov)$[13]

Adhoc networks are infrastructure less network and created according to demands. In wirless adhoc network where node exhibits high mobility and network undergo dynamic topological changes. Broadcasting is one of the important operation in wireless adhoc network for emergency message transfer, discovering services etc. The nature of mobile networks is highly dynamic so it is difficult to do broadcasting effectively. Network contain number of nodes and there is source node initiate broadcast. In many situations emergency message delivery is required towards one particular area or a node fastly. But it is not possible to send the message directly from source to destination. It may cause interpretation of message by intermediate nodes and malicious actions by other nodes. The direct delivering or flooding of message increases the transmission time i.e. need more time for sending message. The repeated message may reach at the same node will creates data loss, wastage of energy, delay, decrease in throughput etc. There are many solutions are there to solve these issues. The main idea or aim of broadcasting in modified time TSS algorithm is to deliver message to the one destination. The time sequence structure algorithm is one of effective way of performing broadcasting and it works according the fixed source and topology. One hop neighboring nodes can disseminate directly with each other, if they are in their own communication range[13] and only uses one hop information hence not need to know position information about the nodes and networks. The algorithm choose the optimal path and minimize the number of transmission. But the deployment of TSS algorithm is not practical in highly dense and dynamic networks. The modified TSS algorithm is capable to work even in random, dense topology and also highly mobile network. The TSS algorithm approximates the centralized greedy transmissions of nodes order in time, by permitting the transmission of the nodes with larger ResCov values first than the nodes with smaller ResCov values. Suppose T be the sequence of time slots, is enforced by structured sequence of time slots, which is locally available to each node, and based on which each node is able to appropriately lineup its own transmission. The lineup procedure is associating a particular ResCov threshold with each time slot by utilizing Algorithm B. The residual coverage value associated with each upcoming time slot should be below than the erstwhile threshold value of time slot. According to obtaining broadcast message, then that node marks itself as covered, conclusive its current ResCov, and schedule the node by itself to transmit in a future time slot, depending on its current ResCov. But naive implementation of TSS does not take into consideration the fact that, with each transmission, the set of freshly covered nodes may have ResCov values larger than the threshold of the current time slot. The consecutive time slots lose the ability to time order the transmissions of nodes based on their ResCov values. TSS address this issue by using time sequence, is a repeated reordering of time slots based on decreasing threshold values by utilizing Algorithm A. According to network deployment, Algorithm A is run locally by each node. The broadcast session lasts $|T|$ time slots, which are organized in levels or epochs. Each level has a sequence of time slots, and ResCov threshold value ul rigorously below than the previous time slot's threshold in each subsequent time slot within an epoch. However, the ResCov threshold will be updated at the starting of each epoch. To clearly label each time slot, instead of deploying the threshold value only, deploy a vector of three values(upp, midd, low). The upp vector value is merely equal to ul: the mostest value of the threshold corresponding to the first time slot in T. The low vector value is the number of the level and equals the ResCov threshold value of this level. i.e., nodes with ResCov below than low vector value cannot able to transmit in this epoch. The midd vector value is the threshold value of a time slot. That is nodes with ResCov below than midd vector value cannot able to transmit in this time slot, but they may transmit future in this epoch, given their ResCov value is larger than low vector value. The values of low and midd vectors for all time slots in T depend only on the upp, which is equal to ul. Hence, the number of time slots in a broadcast duration can be expressed as a function of ul[13].

The MTSS algorithm works in dynamic and mobile networks. MTSS provides an opportunity to choose source and destination randomly. Some times there is an emergency to send message from a source to a particular destination fastly, TSS is not the effective algorithm for this need. Because it is difficult to calculate the residual value of the mobile nodes early. It is overcomes in MTSS by allowing communication in between nodes through hello messages for find outing their ResCov. Nodes will communicate with each other by passing their residual coverage value and schedule them self for the transmission. The residual coverage value will be updated in each transmission of time slot. The nodes will always check their one hop neighbors list for the presence of destination node, when it receives the message. The working of MTSS is similar to TSS, it only consider the one hop neighborhood check with in the scheduled transmission time slot T_{bd}. For that each timeslot's Preamble is split in two parts as Preamble 1 and Preamble 2. Suppose node p is scheduled to transmit in a time slot T_{bd}. Node p computes its ResCov value, during the Preamble 1, by sending the CRq request packets and receiving CRp reply packets. Next, during Preamble 2 of time slot T_{bd} node p checks

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whether any of its one hop neighbors are scheduled to transmit within the time slot of T_{bd} too. Any additional transmissions does not required for this checking process

The modified algorithm covers maximum number of nodes in each transmission. The modified TSS algorithm perform routing according to the position and mobility of nodes. It is not possible in existing TSS algorithm because it is difficult to calculate the RC value nodes in highly mobile network. When mobility increase the neighbors will be changed, one hop value will be changed. Then algorithm will be fail to get optimal path and lead to decrease in performance of the network.

IV. PERFORMANCE EAVALUATION

The modified TSS algorithm perform routing according to the topology and mobility of nodes and covers maximum number of nodes in each transmission. It not possible in existing TSS algorithm. The performance comparison is given bellow

Delay
In the experiment average degree of nodes various from 10,

Fig. 3. Delay

20, 30, 40 and 50 and delay various from 0.1, 1, 1.5,... and 9. The x-axis represents the average degree nodes whereas the y-axis represents the delay. The delay in a network is the number of time required to complete a broadcast period represented in Figure 3. The MTSS and TSS algorithms have comparable delay, slightly less delay than TSS.

Network coverage
The network coverage can see from Figure 4. The x-axis rep-

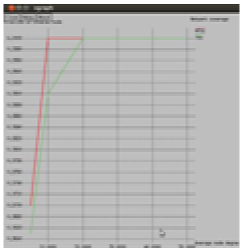

Fig. 4. Network coverage

resents the average degree nodes whereas the y-axis represents the fraction of covered nodes. Network coverage is number nodes covered in one broadcasting period in a network. Even disconnections in the network are possible, in lower node densities the MTSS algorithm is approximately 98%. The performance of MTSS is robust in higher network density and achieve almost full network coverage. The examinations shows the MAC layer is easily manage not beyond the number of control messages, as increase with density. In all densities in network, MTSS maintains higher network coverage than TSS and guarantee full network coverage.

Number of transmission

The number of transmission is a count of transmission

Fig. 5. Number of transmission

required to reach the destination. It indicate that how many number of transmission required is Shown in Figure 5. The x-axis indicates the average degree nodes whereas the y-axis represents the number of transmission. Average node degree varies from 10, 20, 30..50 The modified TSS algorithm minimize the number of transmission required. Hence it avoid or reduce packet loss, delay etc. Comparing the number of transmission of MTSS with TSS, there is 20% lower transmission is required in MTSS.

Transmission complexity

The number of transmission during a broadcast period is

Fig. 6. Transmission complexity

referred as the transmission complexity, is investigated in Figures 6. The parameter ul is fixed and arranged judicially and network wide at the time of network deployment. The value a should be resolutely chosen. The too small value of parameter ul does not allow detach in time the transmissions of nodes with different values of ResCov, thus losing the ability to assign larger priority to nodes with larger ResCov values, while a too high value of ul results in many empty time slots, thus leading to an needlessly long broadcast period.

The density variation should be reconcilable. The transmission complexity never increased with increase in number of nodes. It should be optimal or with in the limit. Otherwise it may increases the delay, residual coverage of nodes, cost, energy and decreases the throughput etc.

V. CONCLUSION

The modified time sequence structure algorithm is capable of handling the dynamic network as well as with mobile nodes. But the algorithm drop its performance when the mobility of nodes increase beyond the range of that network. In such situation to calculating the residual coverage of nodes become difficult and the communication between nodes are not possible because of the movement of node crosses the communication bounds. This is one of the limitation of this algorithm.

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