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Congestion Control Technique with Safety Transmission of Messages in Vehicular Ad Hoc Network

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Abstract - *Vehicular Ad hoc Network (VANET) is somehow similar to MANET. As there are mobile nodes present in MANET in the same way vehicles are present in VANET. If we compare it with MANET, VANET have dissimilar characteristics. When the channels are saturated by the nodes, the congestion occurs in channel. Chances of congestion in the network increases with the increment in number of collision occurrence and this is all because of increase in the density of vehicle. In this paper we propose RT-MMF algorithm to control the congestion in VANET and to deliver safety messages through nodes, encryption and decryption technique is used. We are also going to learn the performance of the proposed algorithm. We are evaluating the result of our proposed method through simulation using NS2. In this paper we are also comparing previous technique with our proposed method.*

Key Words: **VANET, MANET, Congestion Control, RT-MMF, Network Simulator.**

1.INTRODUCTION

Vehicular Ad hoc Networks (VANET's) uses Intelligent Transport Systems (ITSs) to operate wireless communications in the vehicular environments. VANET's are designed to provide consistent and safe surroundings for users to reduce the road accidents, traffic jams, and fuel consumptions, and so on. The VANets' users can be informed of hazardous situations by vehicular communications and exchanging the information about surrounding environments. VANET's have some unique characteristics such as high mobility, high rate of topology changes, and high density of the network, and so on. IEEE 802.11p[1] is a protocol that specifies the features of IEEE 802.11 protocol in PHY and lower part of MAC layers to transfer data in vehicular environments. This protocol employs an MAC layer protocol based on Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) for disseminating data in VANET.

Vehicular communication includes both Inter-Vehicle Communication (IVC) and Vehicle to Infrastructure communication. VANET's are designed to improve the road safety and traffic efficiency in the vehicular environments. Due to the dynamic nature of the traffic in roads, some gaps may be created between the vehicles and consequently remote node clusters can be created in the roads and it leads to accidents.

To avoid this problem the warning messages must be sent to the vehicles for avoiding further collision. We have to study the probability of sent messages from vehicles and the received safety messages and also the delay that will occur in sending the message for future recipient.

In high mobility environment DSRC[3] will not worked properly. Therefore, a new Relaxation Max-Min Fairness algorithm (RT-MMF)[4] is introduced to increase the system's reliability and probability of receiving packets and decreasing the delay for transmission. In rest of the paper we will see related work, the comparison between the previous technique and the proposed one, evaluation of proposed system.

2. RELATED WORK

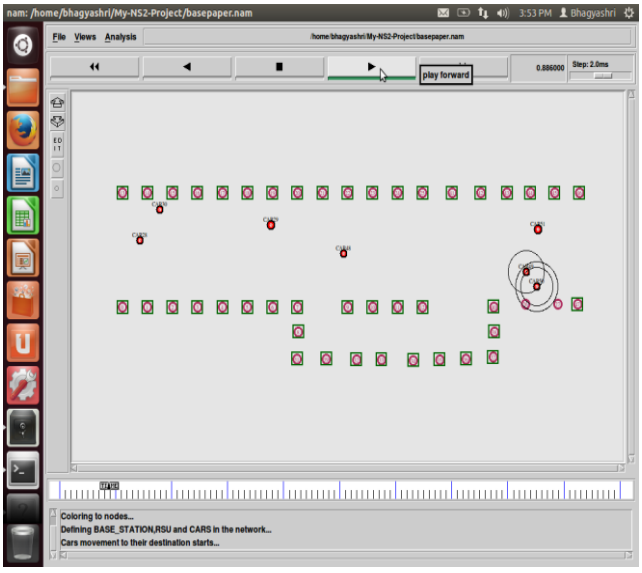
Varsha H,, Pradeep , (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 5 (2) , 2014, [1] In this paper, performance evaluations of safety message dissemination in VANETs in Vehicle-to-Vehicle communication (V2V) are considered. The vehicles which are considered as nodes in VANET communicate or exchange messages with each other, which is referred to as V2V or Inter-Vehicle Communication (IVC). V2V communication is implemented through Dedicated Short Range Communication (DSRC)[3] protocol. The main advantage of the V2V communication with DSRC will be decreased delay and efficient broadcasting of safety messages to far away nodes as possible.

Meenal Pannase January 2014 [2] In this paper we suggest priority based congestion control algorithm as answer to avert congestion in VANETs natural environment. We also study the production of proposed priority based congestion control algorithm for VANET in difference congested scenarios. The

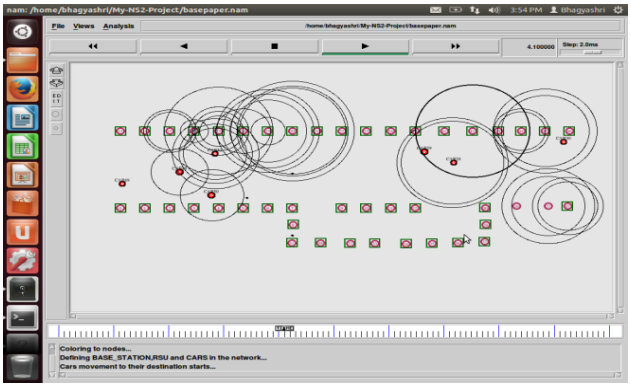
effectiveness of the proposed priority based congestion control algorithm is considered through the hardware and conclusions will be shown on .net. This new imagination is alleviated congestion in network, increases the throughput and package consignment ratio and furthermore minimizes delay.

3.ADAPTIVE AND MOBILITY BASED ALGORITHM (AMBA)

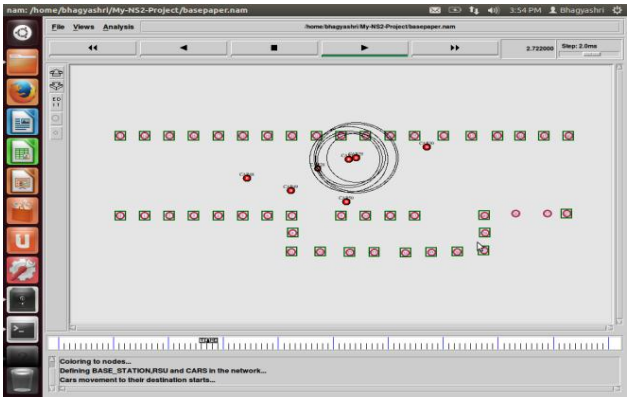
Basically we are comparing the system using two methods one is previously used AMBA and the other one is our proposed system RT-MMF. So first we see how AMBA technique works. Basically AMBA (Adaptive And Mobility Based Algorithm**)** algorithm allows more vehicle to send their status message within the network. Here we are showing vehicular ad hoc network using NS-2[7] so we can consider the vehicles as a nodes. In AMBA algorithm while transmitting messages through nodes the collision might be occurred and hence the number of packets dropped is high and it affects the efficiency of the network and the algorithm.



Screenshot-1: Structure of Network in AMBA Algorithm



Screenshot-2 : Message transmission through network



Screenshot-3: Collision occurred while transmitting messages

In above figure we can see how the vehicles are travelling and transmitting messages through network but while transmitting the messages among vehicles the collision might be occurred as we can see in the screenshot 3 and the energy required for this transmission is more as compared to RT-MMF because all the nodes are participating in transmissions. So the delay might be occurred but the packets dropped while transmitting through nodes are high. So the efficiency of this method is low and the security provided for transmission is also not feasible.

4.RELAXATION MAX-MIN THEORY ALGORITHM (RT-MMF)

Our system design can be divided into two main parts, namely Relaxation Theory (RT) and Max-Min Fairness (MMF)[4]. The conceptual view of original RT and the flow diagram of our proposed system design are as illustrated in Fig.1. Both of our proposed methods are chosen based on their unique characteristics in dealing with congested networks.

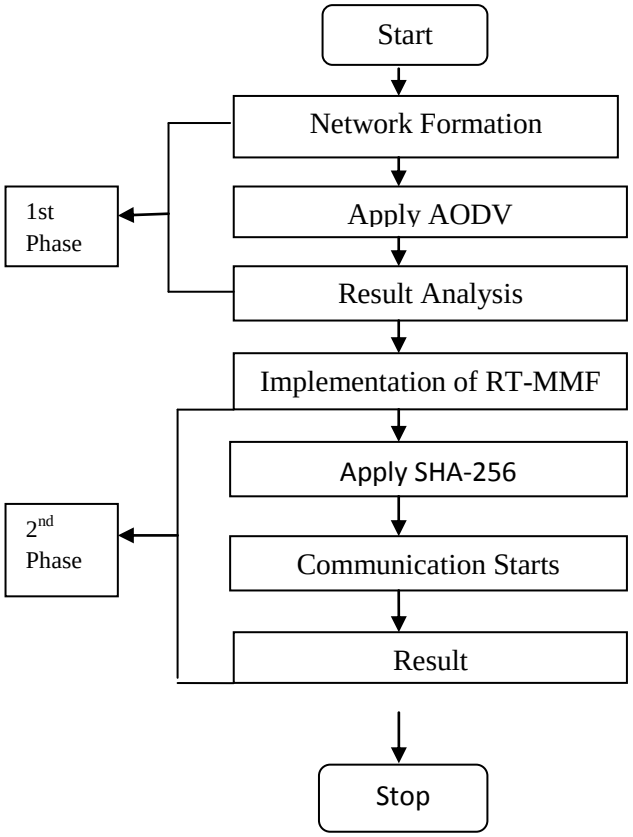


Fig-1: Relaxation Theory (RT) and Max-Min Fairness (MMF)

The system is divided into three modules. The first one is just showing the active deactive concept of network, the second one is RT-MMF which flow diagram we have seen in above fig:1 And the third one is Encryption decryption algorithm. In the first module we have shown how we can use active deactive concept to save energy of the system. As all nodes are not participating in the transmission. Firstly in WSN[8] multiple nodes are participating in communication so lots of energy is lost. So to save this energy and to avoid collision we have to activate only those nodes which are responsible in sending packets from source and destination. In the second module we are applying congestion control algorithm RT-MMF. For this purpose we consider the neighboring nodes of a sender and calculate the distance between the node and the source and whichever node having minimum distance consider that node as the next one in our route and then repeat the procedure until we cannot reach our destination.

To control the congestion we apply RT-MMF[4] algorithm. The RT is chosen to control the rate at which the packets can be sent from each node. The control transmission rate is called Engineering Level (EL) (L(f; _) which is defined as the number of slots based on available bandwidth, in order to transmit the incoming packets (potentially after some buffering), without any additional loss or delay. This technique also allocates fair share of bandwidth to each packet while minimizing the occurrence of congestion. In this algorithm EL is the most important factor if it exceeds the threshold bandwidth, our communication will be stop and EL will be reset. The algorithm we used is as follows.

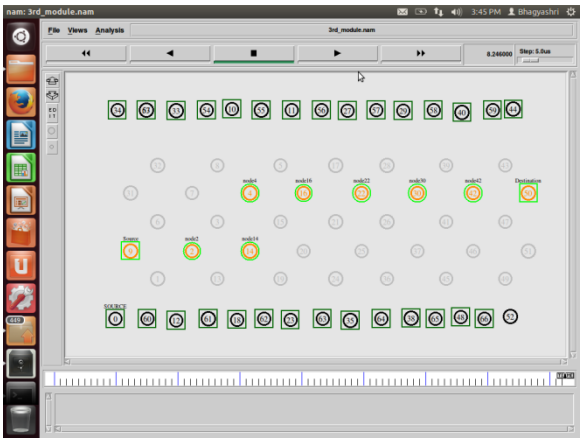
```
Initialize EL=0.
For(I=0; I<length; I++)
{
Repeat source to destination communication while
        loop length.

El++;

If(El==250)

{

Break;

}

}

Prints("The bandwidth limit exceed resulting El to
zero(0)");
```

For the security purpose we are applying encryption and decryption algorithm. In order to safely broadcast messages from source to destination we have to encrypt the message. For this purpose we are using SHA-256 algorithm. The SHA-256 compression function operates on a 512-bit message block and a 256-bit intermediate hash value. It is essentially a 256-bit block cipher algorithm which encrypts the intermediate hash value using the message block as key.

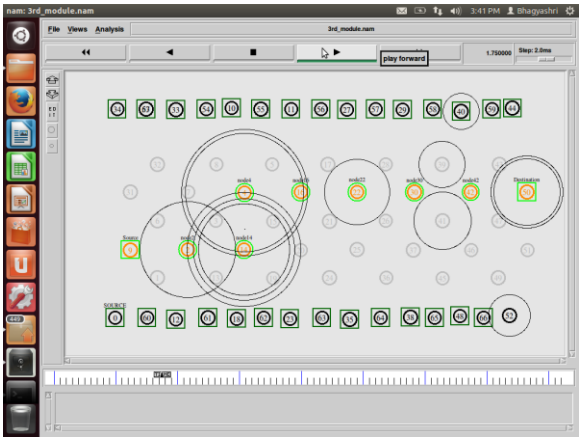
5. RESULTS AND DISCUSSIONS

Simulation[9] has been approved using a powerful Network Simulator-2 (NS-2) [7] to determine the performance of the proposed method. RT-MMF is purposely designed to provide high traffic rate during simultaneous data transmissions in WBSN [5].In this section firstly we see our proposed system and then we will see the comparison between the previous system and proposed one through graph and tables. In our

proposed system as we are using active and deactivation concept that saves the energy of the nodes ultimately energy of the system and it reduce the most important problem that is collision. So the packet delivery ratio is high as compare to the AMBA algorithm. So in screenshot 4 we can see the basic network of our VANET , the active and deactive nodes which represent the shortest path to deliver packet from source to destination.

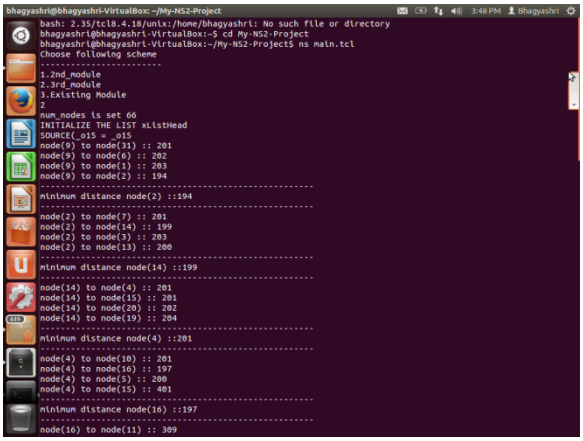


Screenshot-4: Basic view of Proposed System



Screenshot-5 : Packets delivered through source to destination

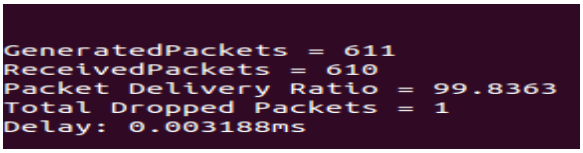
In above screenshot 5 we can see how packets are delivered from source to destination. As we are using active deactive concept, the packets passed only through the active nodes and in this way we can save energy and time required to delivered packets.



Screenshot-6: Minimum value calculation

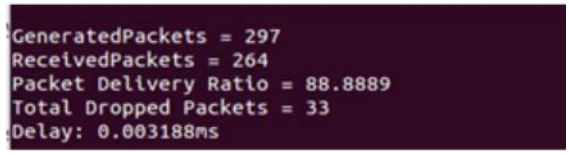
As shown in screenshot 6 we can see how the particular nodes are selected for transmission of the packets. From the root node we consider the neighboring nodes which are at minimal distance. Then according to their X and Y axis positions of both the nodes we calculate the distance. This procedure will be repeated for all the neighboring nodes which are nearer to the root node. Then after getting the entire node's distance, we consider that node only that has minimum value. And that node will be the next node in the path of transmission.

In this way we have to calculate the minimum distances and make route till the destination.



Screenshot-7: Result of Proposed system

Screenshot 7 shows the overall result of our proposed system. In which we can see the number of generated packets, received number packets, the ratio of packet delivery, total number of packets dropped and delay if any.



Screenshot-8: Result of AMBA Technology

After generating the result different graphs will be generated in which we can see the comparison between two techniques.

Table-1: Comparison between Energy values of RT-MMF and AMBA Method

AMBA Energy	Proposed System Energy
0	3
0	0
1	3
1	3
2	0
2	0
3	0
3	0
4	0
4	2
5	2
5	0
6	2
6	4
7	4

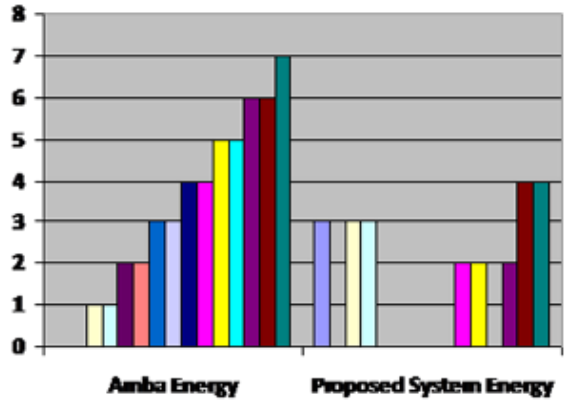


Chart-1: Comparison of Energy Value

Table-2: Comparison between Jitter Values RT-MMF and AMBA Method

AMBA Jitter	Proposed System Jitter
0	0
0	0.000424
-0.000939	0.000283
-0.000352	0.000212
-0.000282	0.000074
-0.000027	0.000161
0.001051	-0.000563
0.001078	-0.000504
-0.004156	0.00018
-0.000064	-0.000489
0.000171	0.000326
-0.000764	-0.000291
-0.000828	-0.000435
-0.000671	-0.000143
-0.000822	0.000219

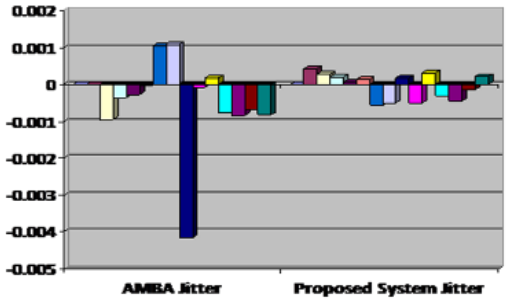


Chart- 2 : Comparison of Jitter Values

Table-3: Comparison between Throughput Values

AMBA Throughput	Proposed System Throughput
8	8
16	17.6
24	27.2
32	36.8
40	46.4
48	56
56	65.6
64	75.2
73.6	84.8
83.2	94.4
92.8	104
102.4	109.6
112	118.4
121.6	126
131.2	131.6

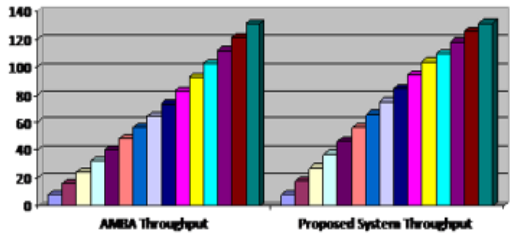


Chart-3: Comparison graph of Throughput Values

Table-4: Comparison Values of delay

AMBA Delay	Proposed System Delay
0	0
0.001408	0.000848
0	0.000848
0.000249	0.000848
0.001016	0.000729
0.000271	0.000848
0.004871	0.000003
0.000283	0.000017
0.001315	0.000724
0.000108	0
0.000948	0.000848
0.000739	0.000205
0.001234	0.000024
0.000925	0.000305
0	0.000683

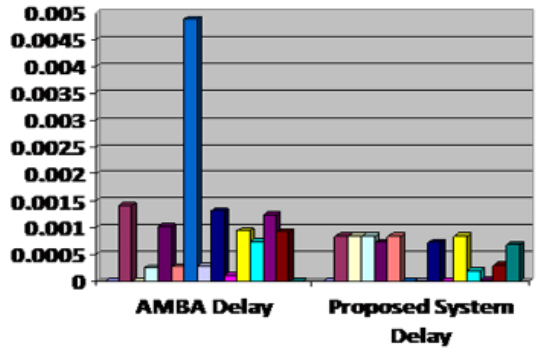


Chart-4: Comparison of Delay values

As we have seen the entire table and graphs which shows the comparison between the previous method AMBA and proposed method. From this graph we can

say that the AMBA is less efficient than the proposed system.

6.CONCLUSION

In this project we are discussing about how we can avoid the problem of congestion and collision. For evaluation purposes, we have performed simulation analysis using NS-2[12] and showed that across multiple nodes scenarios RT-MMF always performs much better than the previous one. Here we are comparing the results of two techniques one is previously invented AMBA and the other one is proposed RT-MMF technique. By using RT-MMF we can avoid congestion and collision in the network. RT-MMF is able to reduce congestion during simultaneous data transmission, which is a significant indication of its efficiency. By using encryption decryption we can ensure the security of messages that are transmitted over the network. Energy required for execution will required less. As we are calculating throughput i.e. the ratio of packets delivered from source to destination is more than the AMBA. From the results we conclude that our proposed system is more efficient than the previous one.

7. FUTURE SCOPE

As we have performed this project using simulation but we can do this project in real time also. But the cost goes very high. As this project is very useful in the area where the traffic is the main cause. So we can use this project using some hardware equipments and sensors. We can use this project in parking areas also as in high traffic area parking of vehicles is very difficult task so by implementing this project in future we can solve the parking slot problem. Future work includes the thought of network coding as a way to increase routability, improve congestion and overflow prevention. This technique offers several advantages including solving complicated routing that cannot be solved using the traditional approach.

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