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RESEARCH PAPER

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VEHICULAR NETWORK DECONGESTION USING SMART TRAFFIC MANAGEMENT

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Abstract: The vehicular ad-hoc network (VANET) is the network of vehicles, which is designed to enable the multi-service architecture across the vehicular networks. The VANETs are the network of the moving nodes on adequately higher speeds, which create the great challenge to gain and through the data from and to the vehicular nodes on the move. The VANETs are used to predict the traffic jams, hurdles or blockades produced due to tree falling, avalanche, flash flood, etc. The minimized delay oriented vehicular networks must be designed over the high speed transmission podium along with efficient data transmissions with optimized number of topology, hello and update packets. In this paper, the major improvements have been proposed in the hazard routing protocols (HRPs) specifically designed for the vehicular networks. The optimized number of hello packets, minimized topology packets and dedicated routing models are involved in the design of the proposed efficient data handling model. This model has undergone the variety of versatile performance evaluation experiments, which proves the improved performance of the proposed model. The maximum delay in the simulation model has been recorded nearly at 0.064 microseconds, which is considerably lower than the existing model. Also the proposed model has been designed to lower the data loss rate by 0.4%, which also proves the robustness of proposed model in comparison to existing model.

Keywords: Traffic optimization, traffic shaping, decongestion, smart traffic management.

I. INTRODUCTION

VANET is a vehicular impromptu system. In VANET the autos or vehicles are moving as hubs amid a system to make a portable system. [1] In a VANET each working together and included vehicle go about as a hub or remote switch, and enabling them to make a wide range arrange between hundred to three hundred meters remove. [2-3] At the point when the car far from of the flag go then the car drop out of the system and another new up and coming vehicle will participate, because of the network of car to each other autos make a portable web. [4] For a well being capacity assessed that the main arrangement of this innovation will incorporate in fire and police vehicles. [5] In transportation framework, vehicular networks are created to upgrade the proficiency, wellbeing and security, and empower new portable capacities, administrations and applications for the travelers. [6-7] For the more drawn out term shrewd street traffic administration frameworks the vehicle or car arrange is turned into an imperative part. [8] A future insightful street traffic administration framework has many key benefits difference to the present traffic administration frameworks. [9] The principle merits are change or fix data fundamentally based continuous traffic flag frameworks, lessened transport outflows and enhanced security and wellbeing of transport traffic. [10] Analysts in traffic administration frameworks and correspondence designing drew in for a significant decade to assemble fitting vehicular adhoc networks (VANETs) for traffic security frameworks including driver and traveler wellbeing. [11-12]

II. LITERATURE REVIEW

Dias .A.J. et al. proposed (2011) "Test bed-based Performance Evaluation of Routing Protocols for Vehicular Delay-Tolerant Networks" [13]. According to the paper on a VDTNs (vehicular delay tolerant networks) the test bed performance valuation of DTN-based routing protocols is used. Hung c.c. et.al.proposed (2008) "Mobility Pattern Aware Routing for Heterogeneous Vehicular Networks" [11]. According to the paper conventional protocols of ad hoc routing have no similar temperament for this high dynamic network. Ghaleb F. et al.proposed (2013) "Security and Privacy Enhancement in VANETs Using Mobility Pattern" [7].According to the paper in a VANET a mobility pattern based mistreatment detection approach. The offender is often categorized as outsider and insider. Outsider is a type of interrupter goal to intercept, wrong use or interrupt of the communications link between VANET's nodes. Insider, on other hand could be a legitimate node would possibly intentionally

or unintentionally create unauthorized or undesirable acts (Mistreatment), like update or change, fabricate, drop the messages additionally to, and impersonate different node identities. Prasad O. et al. Proposed (2012) "Cross Layer Optimization of VANET Routing with Multi-Objective Decision Making" [14].According to the paper Vehicular Ad-hoc Network (VANET) and alternative mobile ad-hoc (MANET) network has completely different characteristics from each other. Because of the dynamic position of the automobile the routing becomes a complicated issue because they behave as routers and radio links are connected with purchasers. Tashakkori H. et al. purposed "Load Balanced VANET Routing in City Environment" (2012) [15]. According to the paper VLBR (VANET Load Balance Routing) protocol is used for VANET as a result of several routing protocols is planned for VANET. Many of them has centered on geographical routing attributable to VANETs technical specifications. Smara G. et al. Proposed (2010) "Security Analysis of Vehicular Ad Hoc Network (VANE T)" [16]. According to the paper number of protection issues, difficulties and complications of VANET has examine and explore. According to the author of the paper additionally settle these difficulties and issues to analyze the set of solution. Each vehicle or car has OBU (On Board Unit).

III. SIMULATION MODEL

This project is based upon the traffic flow optimization to gain the maximum performance on the given vehicular network, which is designed as the structured network. The structured vehicular network is enabled with the vehicular nodes and road side units (RSU) with versatile connectivity paradigms. The vehicle to vehicle (V2V) and vehicle to infrastructure (V2I) are offered among the given vehicular cluster in order to establish the elongated connectivity among the nodes out of the 1-hop reach of RSU nodes. The vehicular networks are aimed at decongestion using the several mechanisms in the proposed model. The primary solution involves the traffic isolation and prioritization applications to set the priority of the data being propagated over the given paths. The data is classified on the basis of the type of the data packets, such as collision oriented packets, congestion indication packets, hello packets between nodes, packets carrying location coordinates and other updates. These packets are handled in the dynamic way to isolate the vehicular traffic in the given segment using the following algorithm:

Algorithm 1: Vehicular Data Flow Prioritization Algorithm

1. Begin the simulation nodes
2. Start the communication module on all of the nodes
3. Establish the connections between the road side units (RSU) and vehicular nodes
4. Start the cluster node movement according to the pre-programmed movement schedule
5. When RSU receives the packets, it analyzes the packets on the basis of their types
    a. If the packets are collision, abrupt (sudden brakes) or congestion packets
        i. If packet is collision packet
            1. Update the packet header with two bit pattern [1 1], which indicates the higher priority
        ii. Else if the packet is abrupt packet
            1. Update the packet header with two bit pattern [1 0], which indicates the higher priority
        iii. Else if the packet is congestion packet
            1. Update the packet header with two bit pattern [0 1], which indicates the higher priority
        iv. Restore the packets in the queue
    b. Otherwise {location, hello and others}
        i. Update the packet header with two bit pattern [0 0], which indicates no priority
        ii. Restore the packets in the queue
6. Process the queue, and iterate for each packet in the queue
    a. Firstly obtain all of the packets carrying priority information [1 1] towards the vehicular nodes
    b. Iterate for each of the packet in collision with bit pattern [1 1]
        i. Acquire the packets one by one
        ii. Observe the location of the node sending the information
        iii. Shortlist the nodes, which can probably get affected by the location of collision
            1. Forward the packet to all shortlisted nodes
        iv. If current packet is last packet
            1. Break the iteration
        v. Otherwise
            1. Go to 6(b)(i)
    c. Iterate for each of the abrupt packet with bit pattern [1 0]
        i. Acquire the packets one by one
        ii. Observe the location of the node sending the information
        iii. Shortlist the nodes, which can probably get affected by the location of collision
            1. Forward the packet to all shortlisted nodes
        iv. If current packet is last packet
            1. Break the iteration
        v. Otherwise
            1. Go to 6(b)(i)
    d. Iterate for each of the congestion packet with bit pattern [0 1]
        i. Acquire the packets one by one
        ii. Forward the packet to all nodes in the given segment
        iii. If current packet is last packet
            1. Break the iteration
        iv. Otherwise
            1. Go to 6(b)(i)
    e. Return the iterations
7. Stop the simulation after the simulation time expires
8. Return the simulation parameters

In this simulation model, the traffic shaping and optimization has been achieved with the traffic flow recognition and prioritization to mark the high utility packets with highest priority on the basis of pre-defined set of rules. In figure 3, the workflow of the proposed simulation model is elaborated in detail:

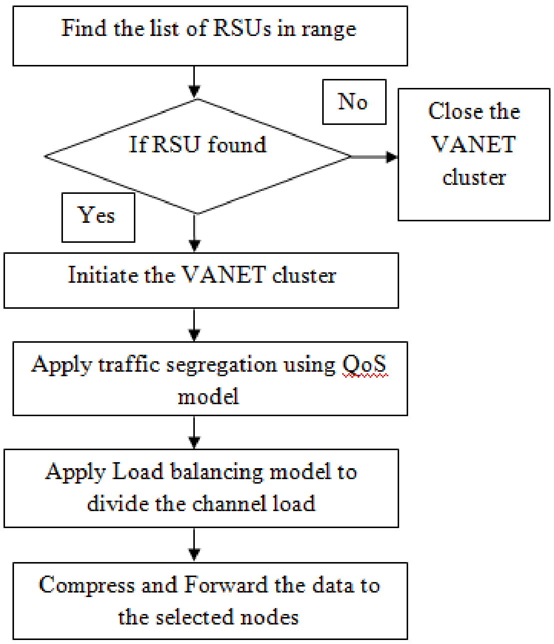

Figure 1: System flow diagram

IV. RESULT ANALYSIS

The simulation results are obtained in the form of various parameters, which involves the end-to-end delay and packet loss in the cluster. The aim of the proposed model is to reduce the end to end delay and to increase the throughput.

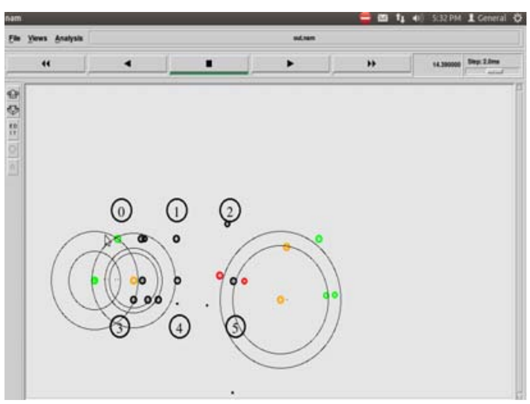

Figure 2: Showing the detected collision and most affected node in the bottom near 5th BTS in red color and less affected nodes in orange color

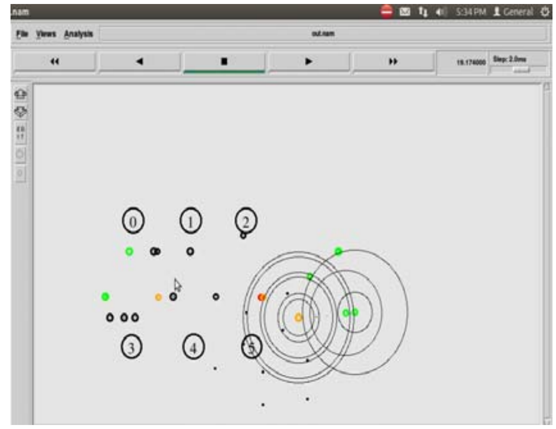

Figure 3: Showing the detected collision (infused red & orange colors) and most affected node in the bottom near 5th BTS in red color and less affected nodes in orange color

Also the number of hello packets has been reduced, when the congestion occurs in order to control the total count of packets in the cluster, which also affects the total count of packets in all of the vehicles in the vehicular cluster. The following figure 4 shows the end-to-end delay, where the proposed model value is quite lower than the delay recorded in the existing model. The delay is reduced because the overall count of hello packets has been reduced in the simulation model.

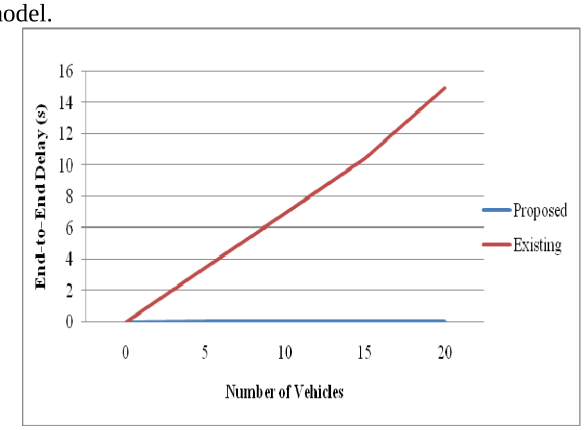

Figure 4: Simulation Parameter of End-to-end transmission delay

The overall end-to-end delay has been recorded nearly at 0.064 seconds, which shows the robust performance of the proposed model. The existing model has been recorded between 0 and 15 seconds, which is significantly higher than the proposed model. This comparison proves that the performance of the proposed model is significantly improved than the existing models.

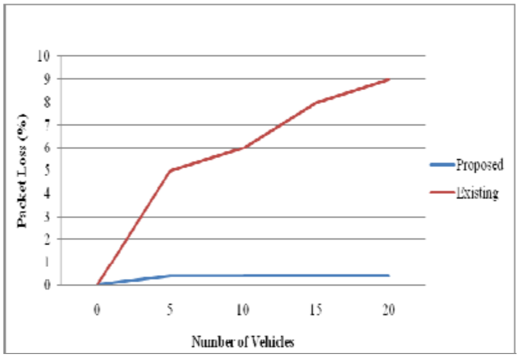

Figure 5: Simulation Parameter of packet loss

The number of hello packets in the hello packets has been estimated in the case of existing and proposed models. In the proposed model, the number of hello packets has been reduced for each of the node in the transmission to improve the overall performance of the proposed model in comparison with the existing model. For each of the node, the number of hello packets to the RSU is limited to two packets per second, which eventually reduces the packet loss in the proposed model. In the figure 5, the packet loss based parameter estimation has been recorded for the existing and proposed models. The existing model has been recorded between 0 and 9 percent packet loss in the given cluster, whereas the proposed model has been recorded between 0 and 1. The dynamic hello packet control among the intersections has significantly improved the packet loss in the proposed model. The packet loss has been recorded nearly at 0.5% on the average, which is very lower than existing model (5-6%) as per shown in the following figure.

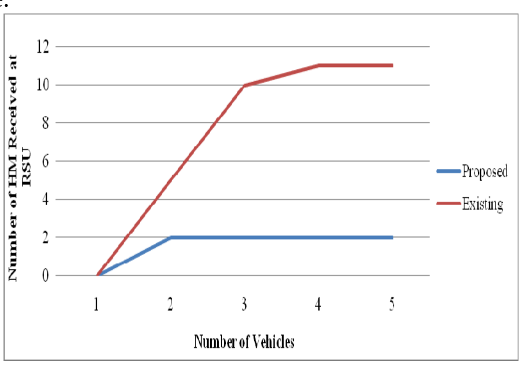

Figure 6: Tracking of number of hello messages among the RSU node

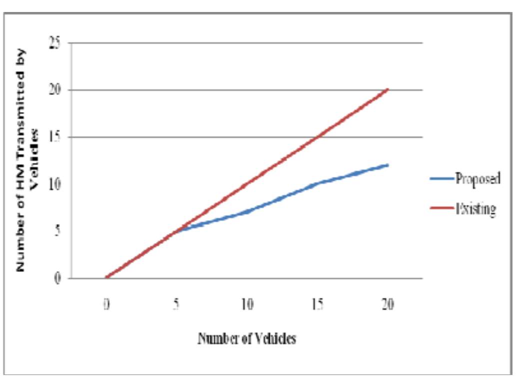

Figure 7: Total number of hello messages among the vehicular cluster with 100% activity

The performance of the proposed model to handle the hello message has been found efficient in the case of proposed model as per shown in figure 6. The total number of hello message received is recorded between 0 and 2 from each node on each time event (round), whereas the existing model is found between 0 and 11 hello packet from each node in the non-fixed domain. Hence, the fixed domain with two hello packets every second in the proposed model is found successfully achieving the goal to maintain the infrastructure connectivity, as well as optimizing the delay and packet loss. The total number of hello packets in the cluster is found significantly lower among the vehicular network in the case of proposed model, when compared to the existing model. The proposed model's fixed domain hello packet count (two packets per second) is found efficient in comparison with the existing model as per shown in figure 7.

V. CONCLUSION

The proposed model is based upon the traffic shaping by incorporating the flow prioritization over the different kinds of packets and flow isolation to segment the affected nodes among the given cluster. In the proposed model, the proposed flow isolation and flow prioritization mechanism is designed to improve the network performance, which is significantly improved in the proposed model. The transmission delay has been lowered to 0.064 seconds in the proposed model against nearly 7 seconds in the existing model, which is very high improvement. The existing model ranges between 0 and 15 seconds for all of the rounds in the simulation. The existing model has been recorded between 0 and 9 percent of packet loss occurring in the given vehicular cluster, whereas the existing model is recorded between the range of 0 and 1 percent. The average percentage of packet loss has been recorded between 0.5% in the proposed model, which shows the significantly high performance as compared to the average of existing model (5-6%) of packet loss.

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