COMPRESSING THE BROADCAST STORM PROBLEM IN VEHICULAR AD HOC NETWORKS USING FIREFLY OPTIMIZATION

[1]Raghu Sharma, [2]Sandeep Kad

[1]Research Scholar, [2]Associate Professor
[1]Department of CSE
[1]IKG PTU, Kapurthala, India

Abstract: Vehicular ad hoc networks find their application in making the life easier on the road for the drivers. Such networks broadcast the information about the traffic conditions, road conditions etc. to the vehicles moving on the road. The broadcasting of packets is very large in number since the topology changes at very fast rate due to the fast speed of the vehicles. The problem is commonly known as broadcast storm problem. This research work design an algorithm based on Firefly Optimization Technique to further reduce BSP in SEB algorithm. The work was compared with the existing SEB algorithm based on broadcast storm ratio, delay and packet delivery ratio. These parameters have shown an improvement over the existing scheme.

***Keywords*: Vehicular Ad hoc network, Broadcasting Storm Problem, Firefly optimization.**

I. INTRODUCTION

Though Vehicular Ad-hoc Network (VANET) is definitely not another point, it keeps on giving new research difficulties and issues. The fundamental goal of VANET is to help a gathering of vehicles to set up and keep up a correspondence organize among them without utilizing any focal base station or any controller. One of the significant uses of VANET is in the basic therapeutic crisis circumstances where there is no framework while it is basic to pass on the data for sparing human lives. Be that as it may, alongside these valuable uses of VANET, develop new difficulties and issues. Absence of foundation in VANET puts extra obligations on vehicles. Each vehicle turns out to be a piece of the system and furthermore oversees and controls the correspondence on this system alongside its very own correspondence prerequisites [1].

Vehicular ad-hoc networks are in charge of the correspondence between moving vehicles in a specific domain. A vehicle can speak with another vehicle straightforwardly which is called Vehicle to Vehicle (V2V) correspondence, or a vehicle can impart to a framework, for example, a Road Side Unit (RSU), known as Vehicle-to-Infrastructure (V2I) [1].

Broadcasting in Vehicular Ad Hoc Networks (VANETs) has transformed into a dynamic field of research. VANET applications are normally communicated arranged and oblige the basic correspondence conventions to be strong and versatile. Of course, the common communicate instrument may incite communicate tempest issue which will seriously impact both the steadfastness and flexibility of the conventions. In MANET [2] broadcasting happens during course revelation or course support, for example, AODV course demand hi messages yet in VANET communicate steering is generally utilized in numerous wellbeing basic ITS applications. The system detachment issue for VANET is more serious than MANET because of high versatility brought about by quick moving vehicles, meager traffic densities during off-top hours, and the constrained market infiltration rates of vehicles with prepared specialized gadgets, particularly in the underlying stage. This detachment time (on the request of a couple of moments to a few minutes) makes MANET conventions, for example, AODV inadmissible for VANETs. Subsequently, new system conventions are important to improve broadcasting in thick systems and directing choices in sparse systems.

In dense systems, an unadulterated flooding plan results in exorbitant repetition, conflict, and impact rates causing issues in transmissions, alluded to as the communicate storm issue. Such issue is handled with communicate concealment systems. At the point when the traffic thickness is over a specific worth, a standout amongst the most significant issues is the gagging of the common medium by an unnecessary number of a similar security communicate message by a few continuous autos. In meager system vehicles may face arrange detachments when the transmission range utilized can't achieve different vehicles more distant toward intrigue [2]. In such situations, conventions ought to likewise consolidate a store-convey forward component to exploit the portability of vehicles to store and hand-off messages until another open door for dispersal rises. In such cases directing and broadcasting winds up testing task.

II. BACKGROUND

VANET has many real time applications. But still has several technological lacunas in the technique of background subtraction. In this section, several methods are briefly discussed.

Rehman et al. presented best in class of VANET and examines the related issues. Vehicular specially appointed systems (VANETs) innovation has risen as a significant research territory throughout the most recent couple of years. Being specially appointed in nature, VANET is a sort of systems that is made from the idea of setting up a system of autos for a particular need or circumstance. VANETs have now been built up as dependable systems that vehicles use for correspondence reason on roadways or urban conditions. Alongside the advantages, there emerge an enormous number of difficulties in VANET, for example, provisioning of QoS, high network and transmission capacity and security to vehicle and individual protection. System engineering, signal demonstrating and engendering instrument, versatility displaying, directing conventions and system security are talked about in detail. Principle discoveries of this paper are that a productive and hearty VANET is one which fulfills all structure parameters, for example, QoS, least dormancy, low BER and high PDR. Some key research regions and difficulties in VANET are exhibited toward the end of the paper [1].

Farooq et al. proposed a methodology to defeat the communicate storm issue in VANETs utilizing the bouncing calculation. For productive information dispersal over a system, the most normally utilized arrangement is communicating the messages by flooding the information over the system. Issues worried about flooding are excess rebroadcasting of messages and impact prompting communicate storm issue. The examination and reenactment results outline better execution by a half breed approach displayed by joining the benefits of separation based and counter-based plans as far as reachability and sparing of rebroadcasting which performs productively [2].

Feukeu et al. proposed a Dynamic Broadcast Storm Mitigation Algorithm (DBSMA) which can be utilized to battle the communicate storm issue in a Vehicular Network (VN). Results from a few reenactments affirmed that the DBSMA has a possibility to vanquish the impact of communicate storm by offering over 150% improved effectiveness against the DCC approach. Another preferred position of the DBSMA is that it is easy to process and simple to execute [3].

Sucharita et al. concentrated on study of different communicate storm alleviation methods created for effective information dispersal. In rush hour gridlock security applications for VANETs, some notice messages must be spread so as to build the quantity of vehicles getting the traffic cautioning data. In those cases, repetition, dispute and parcel impacts because of concurrent sending (typically known as "Communicate storm issue") are inclined to happen. So to stay away from this, the information ought to be spread effectively with no loss [4].

Hayat et al. presented a relative speed based sitting tight time calculation for maintaining a strategic distance from communicate raging issue in the VANETS particularly in thick condition. This proposed calculation computes the sitting tight time for every vehicle subsequent to getting the wellbeing/cautioning messages as per the general speed of the vehicles, the separation between the vehicles and scope of vehicles. The outcomes demonstrate that the proposed relative speed based calculation is superior to anything effectively existing calculations like visually impaired flooding and progressively communicating holding up time calculation which uses number of neighbors and separation between the vehicles for ascertaining the holding up time [5].

Chitra et al. presented a comparative investigation of different noticeable BSSA so as to recognize the fundamental issues and difficulties in controlling BSP totally. The result of this paper would give the necessities to building up a productive BSSA defeating the recognized issues and difficulties [6].

Chitra et al. investigated the upsides and downsides of various telecom strategies in VANET. Likewise, the communicate storm issue and communicate concealment procedures for broadcasting in Vehicular Ad hoc Networks (VANET) are talked about, in light of the fact that aimlessly communicating the bundles cause a few issues that influence the nature of administration in VANET. So as to maintain a strategic distance from communicate storm issue this paper gives a review of a portion of the current communicate concealment procedures in vehicular condition [7].

Muthamizh et al. proposed a Spanning Tree based broadcasting for VANET which successfully lessens the start to finish postponement, inertness and significantly improves the bundle conveyance proportion. The proposed calculation is executed in the NS-2 test system and contrasted and the best known TLO (The last one) approach and found to perform better. Since the quantity of rebroadcasts in this traversing tree based calculation is significantly diminished, the quantity of crashes likewise diminishes, along these lines bringing about an effective usage of the network bandwidth [8].

Wisitpongphan et al. quantified the effect of communicate storms in VANETs as far as message postponement and bundle misfortune rate notwithstanding traditional measurements, for example, message reachability and overhead. Given that VANET applications are right now bound to utilizing the DSRC convention at the information connection layer, they propose three probabilistic and clock based communicate concealment procedures: weighted p-constancy, opened 1-ingenuity, and opened p-steadiness plans, to be utilized at the system layer. The reenactment results demonstrate that the proposed plans can fundamentally diminish conflict at the MAC layer by accomplishing up to 70 percent decrease in bundle misfortune rate while keeping start to finish delay at adequate dimensions for most VANET applications [9].

Tonguz et al. reported the first complete adaptation of a multi-bounce communicate convention for VANET. The outcomes unmistakably demonstrate that telecom in VANET is altogether different from steering in mobile ad hoc networks (MANET) because of a few reasons, for example, arrange topology, versatility designs, socioeconomics, traffic designs at various occasions of the day, and so forth. These distinctions infer that regular specially appointed steering conventions, for example, DSR and AODV won't be suitable in VANETs for most vehicular communicate applications. Creators recognize three altogether different routines that a vehicular communicate convention needs to work in: I) thick traffic routine; ii) meager traffic routine; and iii) customary traffic routine. They expand upon our recently proposed directing answers for every routine and we demonstrate that the communicate message can be spread effectively. The proposed plan of the Distributed Vehicular Broadcast (DV-CAST) convention coordinates the utilization of different directing arrangements they have recently proposed [10].

Chitra et al. proposed to suppress the Broadcast Storm Problem and to improve the Emergency Safety message dissemination rate through a new BSSA based on Selective Epidemic Broadcast Algorithm (SEB). The simulation results clearly show that the SEB outperforms the existing algorithms in terms of ESM Delivery Ratio, Message Overhead, Collision Ratio, Broadcast Storm Ratio and Redundant Rebroadcast Ratio with decreased Dissemination Delay [11]

III. PROPOSED WORK

In this work, we intend to use the Firefly algorithm to further suppress the broadcast storm problem in vehicular ad hoc network. Selective Epidemic Broadcast algorithm (SEB) is based on Susceptible Infected and Removed (SIR) algorithm. SIR algorithm would allow the node (which detected the emergency event) to select farthest vehicle from list of the neighbors to further broadcast the Emergency Safety Message (ESM) to the next range. SEB, however, makes an improvement over SIR by introducing the concept of EBN list of neighbors. EBN contains those neighbors which reply back to the source vehicle with a Passive Acknowledgement packet. Thus, instead of choosing entire list of neighbors, SEB reduces the broadcast storm by choosing only those neighbors that have replied with P-ACK.

In this work, we further intend to reduce the number of neighbors in the EBN list by applying Firefly algorithm.

When the source vehicle has some emergency message to send to the neighbors, it will send a beacon message first to identify its neighbors. When the neighbors receive the beacon message, they will compute their attractiveness with respect to the source vehicle as:

Attractiveness (A1) = A0 * exp-γ*d1*d1

Where A0 represents the attractiveness at the unit distance and is considered as 1, d1 is the distance between two nodes/fireflies at time ‘t1’ and γ is the light coefficient.

As per the SEB algorithm, the neighbors will reply back with the Passive Acknowledgment to the source vehicle. The source vehicle will compute the attractiveness as:

Attractiveness (A2) = A0 * exp-γ*d2*d2

The source node will check the rate of change of attractiveness for the neighboring node as:

Rate of change = (A2 – A1) / (t2-t1)

If rate of change of attractiveness is greater than zero, than it would infer that neighbor is moving towards the event. Such neighbors are required to be notified about the event with utmost priority. Now, in the EBN list, the source node will assign a priority index to every neighbor. Neighbors with rate of change of attractiveness more than zero will be assigned value of priority index as 1 and others as 0.

The source node will now forward the ESM to the node having priority index as 1. This will further reduce the Broadcast Storm as encountered in the SEB.

After sending the ESM to the priority neighbors, the source node will choose the neighbor having least attractiveness to further re-broadcast the ESM. The neighbor with least attractiveness will represent the farthest neighbor.

When such farthest vehicle tries to re-broadcast the ESM packet, it will again find its neighbors using beacon message. Now, if any vehicle has already received the ESM packet from the previous source node, the vehicle will not reply with passive acknowledgement to the farthest vehicle. Thus, this will help to reduce the number of packets broadcasted in the network.

IV. EXPERIMENTAL RESULTS

The proposed as well as existing schemes were implemented in network simulator 2.35. The performance of the network was compared based on packet delivery ratio, broadcast storm ratio and delay. The numbers of vehicles were taken as 30 and 38. The mobility of the vehicles was varied from 30 m/s, 35 m/s and 40 m/s.

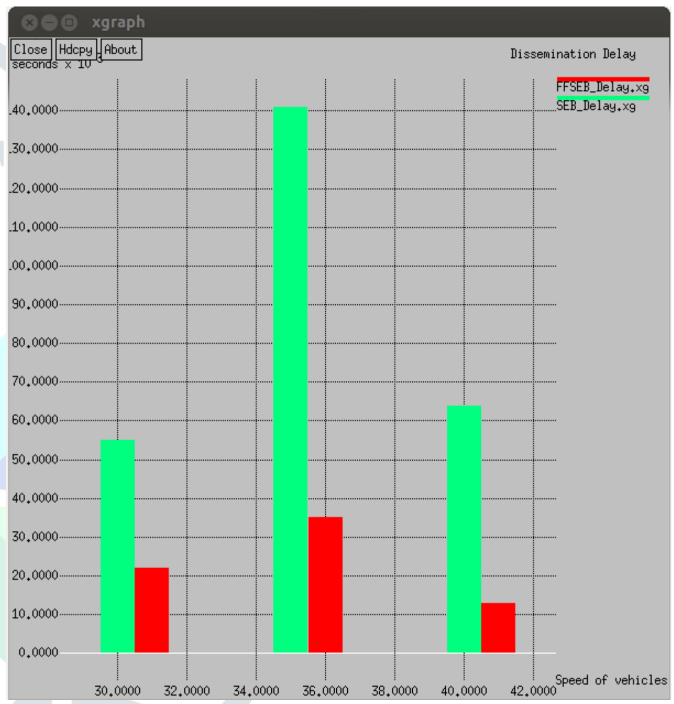

Figure 4.1: Delay Vs Speed of vehicles

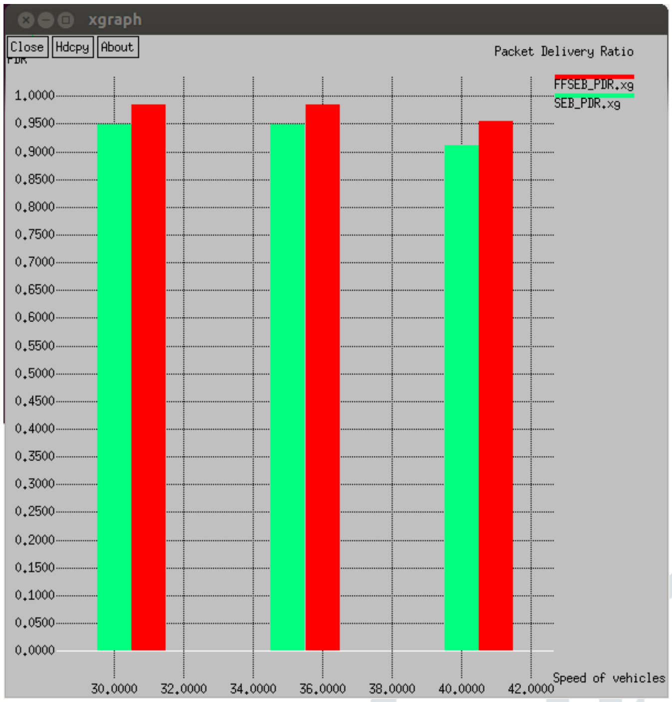

Figure 4.2: PDR Vs Speed of vehicles

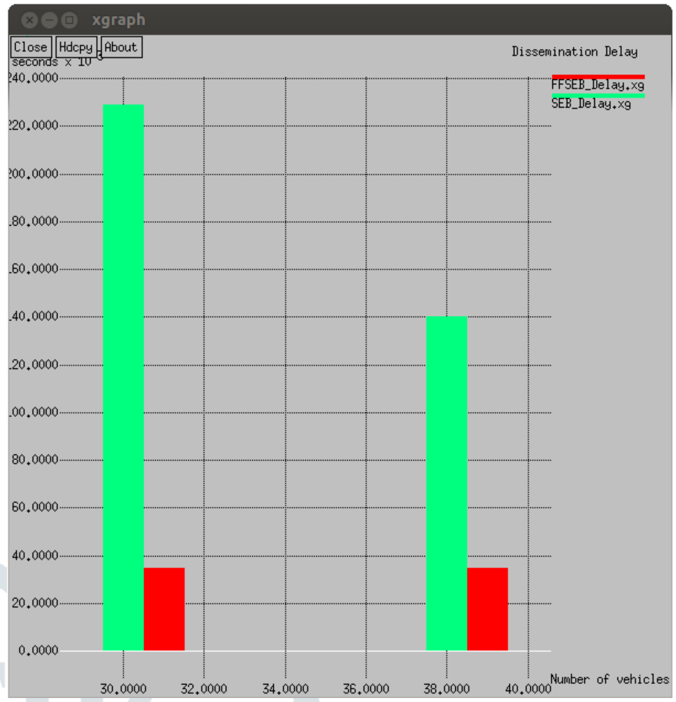

Figure 4.4: Delay Vs Number of vehicles

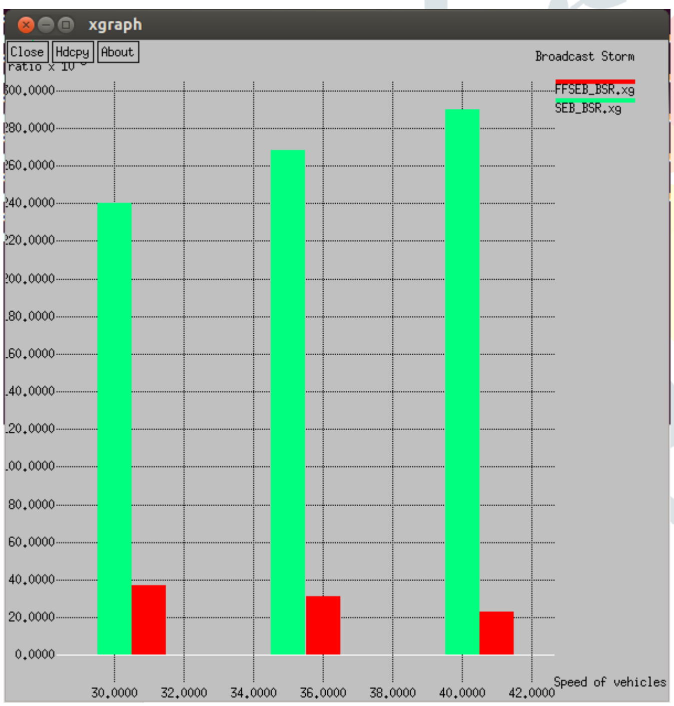

Figure 4.3: BSR Vs Speed of vehicles

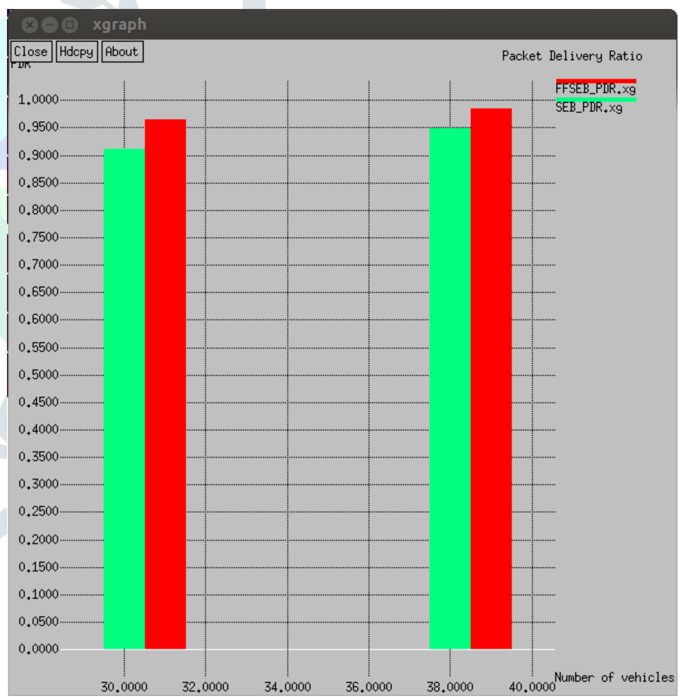

Figure 4.5: PDR Vs Number of vehicles

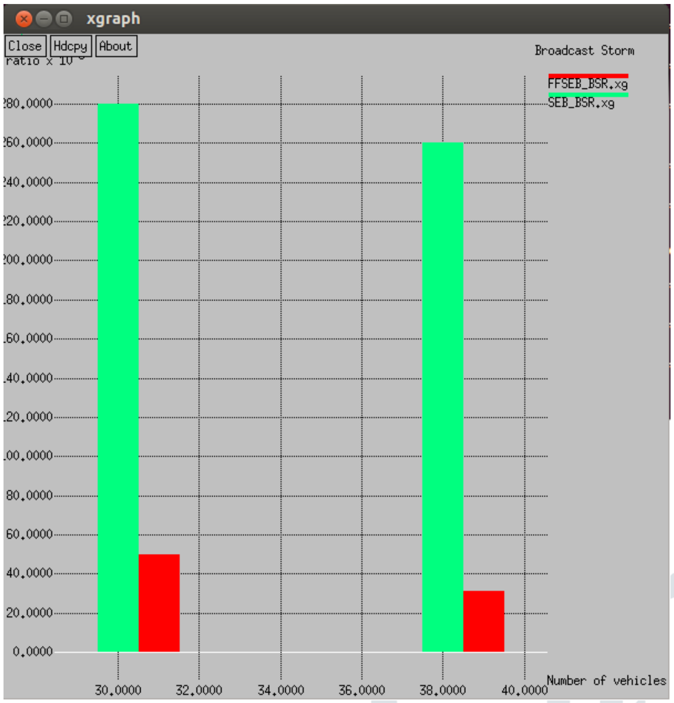

Figure 4.6: BSR Vs Number of vehicles

These above six graphs shows the values of packet delivery ratio, broadcast storm ratio and delay obtained for the SEB and Firefly based SEB technique. Figures 4.1 to 4.3 are obtained when the speed of the vehicles was varied from 30 m/s to 40 m/s while the latter three graphs were obtained by varying number of vehicles. In all the scenarios, the values for all the three parameters have shown improvement with the proposed scheme than existing scheme. In the proposed scheme the farthest vehicles are chosen in all the directions rather than single direction as defined in SEB. This helps to reduce the dissemination delay of the emergency message to the vehicles. Furthermore, the numbers of vehicles in the EBN list generate using the proposed scheme contains few numbers of neighbors because some of the nodes whose rate of change of attractiveness is less than zero get eliminated. This helps in reducing the broadcast storm ratio for the network. With the reducing the BSR, the number of packet drops also gets reduced thereby increasing the PDR value for the network.

V. CONCLUSION AND FUTURE SCOPE

The analysis of the three parameters for both the schemes ensures that the performance of the proposed work is better than the existing scheme. While reducing the number of vehicles in the EBN list reduces the broadcast storm ratio, this also helps in increasing the value of packet delivery ratio in the network. Furthermore the information dissemination by choosing the vehicles in all the directions helps in reducing the delay as well. In future, various scenarios for road intersection and city scenarios can also be considered while analyzing the network's performance.

REFERENCES

[1] Sabih ur Rehman, M. Arif Khan, Tanveer A. Zia, Lihong Zheng, "Vehicular Ad-Hoc Networks (VANETs) - An Overview and Challenges", Journal of Wireless Networking and Communications, 2013, pp. 29-38.

[2] Mohd Umar Farooq, Khaleel Ur Rahman Khan, "Mitigating Broadcast Storm Problems in Vanets", IJSSST, pp. 25-34.

[3] E. A Feukeu, T.Zuva, "Overcoming Broadcast Storm Problem in a Vehicular Network", IEEE, 13th International Conference on Signal-Image Technology and Internet-Based Systems, 2017, pp. 402-407.

[4] Ch.V.S.Alekhya Sucharita, Ch.Vijaya Durga, "A Review on Broadcast Storm Mitigation Techniques in Vehicular Ad hoc Networks", International Journal of Scientific & Engineering Research, Volume 7, Issue 3, March-2016, pp. 200-213.

[5] Umar Hayat, Razi Iqbal, Jamal Diab, "Eliminating Broadcast Storming in Vehicular Ad-Hoc Networks", International Journal of Advanced Computer Science and Applications, Vol. 7, No. 1, 2016, pp. 348-354.

[6] M. Chitra, S. Siva Sathya, "Issues and Challenges in Broadcast Storm Suppression Algorithms of Vehicular Ad Hoc Networks", Informatics Engineering, an International Journal, Vol.3, No.2, June 2015, pp. 11-27.

[7] M.Chitra, S. Siva Sathya, "Efficient Broadcasting Mechanisms for Data Dissemination in Vehicular Ad Hoc Networks", International Journal of Mobile Network Communications & Telematics, Vol. 3, No.3, June 2013, pp. 47-63.

[8] B. Muthamizh, S. Siva Sathya, M. Chitra, "Spanning Tree Based Broadcasting for VANET", International Journal of P2P Network Trends and Technology, Volume 4, Issue 2, 2014, pp. 34-38.

[9] N. Wisitpongphan And O. K. Tonguz, J. S. Parikh, P. Mudalige, F. Bai, V. Sadekar, "Broadcast Storm Mitigation Techniques in Vehicular Ad Hoc Networks", IEEE, Wireless Communications, 2007, pp. 84-94.

[10] Ozan Tonguz, Nawaporn Wisitpongphan, Fan Bai, Priyantha Mudalige, Varsha Sadekar, "Broadcasting in VANET", IEEE, 2008.

[11] M. Chitra, S. Siva Sathya, "Selective epidemic broadcast algorithm to suppress broadcast storm in vehicular ad hoc networks", Egyptian Informatics Journal, 2017.