International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-9 Issue-1, November 2019

Effective Traffic Management System for Vehicular Network

K. Suganyadevi, N.SaravanaSelvam

Abstract—Vehicular ad hoc networks are becoming the promising research topic in Intelligent transportation system. VANET enable the collaboration amongst multiple vehicle communication which supports by their arrangement and infrastructure for consistent data delivery services. Due to high mobility of vehicles, the data cannot be delivered between vehicles with change in their topologies and its becoming an emerging high area in the field of research. However, the ideal characteristics of vanet routing protocols make proper connectivity for reliable and effective data delivery in traffic scenarios. This article starts with traffic congestion and dissemination of the information to nearby vehicles for making smart city into a very smarter one. As a result of miscommunication between the vehicles , severe accidents happened scores of times especially in the traffic prevailing areas. In order to mitigate terrible accidents, We then focus on (traffic light aware routing protocol) TLRC with (Soft Reservation Multiple Access with Priority Assignment) SRMA/PA routing protocols at intersections and traffic light signals under traffic congestion. In Sum, this article enriches the performance of data delivery ratio and end to end delay in exchanging data between Vanet equipped vehicles.

Index Terms—Vanet, Traffic Congestion, Traffic lights, routing Protocols, SRMA/PA.

I. INTRODUCTION

With the swift increase in the count of private vehicles especially four wheeler; traffic congestion has arrive a noticeable problem to be resolved. In order to enhance the safety and secure driving experience and lives of others, Vanets wireless communication facilitates more essential service in an intelligent system of transportation. Routing protocols plays a vital role in VANET where every vehicles can transfer their information from one own vehicles to another in the form of packets. As a result, it draws the intense attention and becomes a key area of research in recent decades. In VANET, different velocities of vehicles are driven in different environments which reducing the network connectivity. This article offers a model design of Vanets in the fig.1 and the detailed treatment on critical requirements and promising solutions for traffic congestion in each of these areas and more.

Revised Manuscript Received on November 30, 2019.
***** Correspondence Author
K.Suganyadevi*, Presently working as A.P in Electronics and Communication Engineering of Sri Eshwar College of Engineering, Coimbatore, Tamilnadu, India.
Dr. N. SaravanaSelvam, Professor, Department of ECE, PSR Engineering College, Sevalpatti, Sivakasi

Due to the challenges and changing nature of a vanet, the designer needs a broad knowledge of understanding the root cause of any congestion issues.

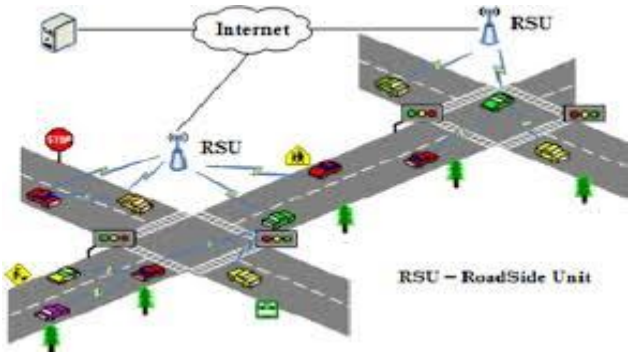


Fig:1 Structure of Vanet

This article is organized as follows. In Section II, we present related works in this field. Section III mainly describes the Proposed Protocol design which is followed by Performance Evaluation and Conclusion in section IV and V respectively.

II. RELATED WORK

The traffic Light influenced the traffic density across the world. In order to analyze the reliable exchanging of data, numerous researchers have developed a finite number of routing protocols which augment the performance in various means to handle traffic congestion.

[1]. Proposed Intersection based Routing protocol i.e., Shortest Path based Traffic light aware routing STAR which determines the forwarded strategy using red lights. Disconnection of vehicles communication happened while under green light amongst clusters. STAR protocol overcomes the difficulties of greedy algorithm in forwarding the data with lower delay and higher delivery ratio.

[2]. Addressed Oldest Job first (OJF) or Oldest arrival first (OAF) algorithm to mitigate the delay at intersections. This algorithm real time vehicle positions and their speed data at an isolated traffic intersection state with the aim of mitigate the delays at intersections. It presents 2 competitive online algorithms to solve conflicts in scheduling operation in diverse system structure. Platooning algorithm divides the traffic into platoons as a job and then assigns each job to the processor which built conflict free scheduling. The Scheduling operation is done on the processors through OJF algorithm and it is suitable for high penetration rates. Once the vehicles are scheduled, then the delay experienced by the vehicle as they move forward through the intersection which is named as start up delay. To solve this issues proper selection of platoon's sizes will be decided to reduce their service time.

[3]. Proposed Proactive routing system which designs from centralized to decentralized i.e., distributed vehicular rerouting system for congestion avoidance. DIVERT offloads the computation to individual vehicles, it can manage to pay for high rerouting frequency or lower congestion threshold, and thus it obtains better result in traffic areas. By reducing the utilization of CPU at the server side and reducing the number of messages between the server and the vehicles improves the system scalability. Vehicles cannot be synchronized due to lack of coordination in distributed structure. During implementation lot many critical experiences could affect the adoption rate. To decrease this deviation, various methods were investigated and deployed in it. Optimization of average travel time computation is complex and expensive in congested areas. However, this proactive algorithm reduces the CPU load by 99%and network load by 95% which strengthens the privacy protection mechanism.

[4]. Proposed Publish–Subscribe based event notification delivered to the vehicles by the Road side Units (RSU).The subscriptions and events are valid only within the validity period .Finite number of RSUs cannot be able to match more subscriptions because of bounded maximum subscription matching and bound minimum cost maximum subscription matching issues. The offline and online algorithms are used to rectify the BMaxSubMatch, BMinCostMaxSubMatch and BMinCostMaxSubMatch in real time issues respectively. This Publish–Subscribe algorithm has the capability of matching maximum Percentage of subscriber with low event dissemination cost for real time traffic circumstances and event notification as well.

[5]. Proposed the principle of queue theory which calculates the waiting time length at intersections and the processes of delay in data delivery is for square i.e., (nxn) grid roads state. This paper proposed data to be passed at intersection in bidirectional roadways. Delay in data delivery between vehicles can be reduced by analyzing the length of intersection and the range of wireless communication either its values are larger or smaller and with the smaller straight lane than left turn on the straight road conditions. when the traffic light is red ,then the delay is reduced in left turn vehicles .While Green, then results small delay in the opposite lane vehicles .More number of RSUs can be added to raise the performance in the roadways. Mobility, Interference of the vehicles and high power consumption affects the system performance.

[6]. Proposed urban street connectivity by deploying street centric protocol called Traffic Light aware routing (TLRC). It explores the traffic light effects on distributed vehicle setup. It divides the street into 3 areas and analyzed their performance using TLRC protocol in each urban area. Street connectivity calculated from middle area of the street distribution and vehicle density which acts as a vital metric for routing protocol in those areas. As the vehicles count increases above 300, then the packet ratio and peer to peer delay tend to be stable on contrast, it boost the channel contention problem. This article focuses on the density and their connectivity which results in improvement of data delivery ratio and decrease end to end delay.

[7]. Proposed Naïve Bayesian Probabilistic algorithm to form stable clustering by estimating the traffic flow (ANTSC). By adopting Clustering approach and cluster head selection algorithm, it reduces the scalability problems. Each vehicle deployed with Global positioning system (GPS) and wheel odometer to identify their direction and measure the vehicle movement for few millimeters. A Bayesian network represents complex probability distribution well and has much consideration. It is also called belief network and its classification characterizes a supervised learning techniques and classification in statistical manner. It uses the knowledge of earlier events to predict future events. This algorithm improves the cluster head lifetime by increasing the communication rage under heavy traffic areas to enhance the cluster operations .It is used not only in urban area but also in highways.

[8]. Proposed real time path planning algorithm based on travelling time estimation (TTE). Information sharing scheme based on distributed transportation system applied in real time traffic with Road side Unit (RSU) which has less computational complexity and redundancy in accidental areas. By the application of path planning on all the incoming vehicles leads to the same destination which cause more congestion. The real time (TTE) path planning algorithm used drift-plus-penalty and a back-pressure policy to rectify new congestion generated by same path selection by all vehicles and improves its accuracy by 70%. Global optimization and load balancing can be implemented in future work.

[9]. Proposed Fast Multihop Broadcast algorithm (FMBA) a decentralized routing protocol for rapid message propagation which diminish latency in critically challenged situations like safety and some emergency state in highways. This approach is based on having different contention windows amongst vehicles as to select the next forwarder in probabilistic fashion to reduce the hop counts to transfer the messages. With more number of vehicles, the contention window size can be increased and the slot is low and decreased with less number of vehicles and high slots. The FMBA algorithm works on probabilistic nature does not choose the farthest node deterministically as a next forwarder. If the selected forwarder fails, then the next farthest node takes the charge of forwarding the alert or broadcast message effectively.

[10]. Proposed software defined network (SDN) and fog enabled Vehicular software defined network (VSDN) principles for fast accident rescue in real time traffic scenarios. The fog improves the traffic control which decrease the waiting time at intersections. Fast Traffic accident rescue (FTAR) ad Traffic Management System (TMS) approaches are deployed to arrive at the accident location upto 80% and 40% and the time loss of 50% and 70% respectively. The VSDN controller controls base stations (BSs) and Road Side Units (RSUs) which creates global connectivity and also responsible for local traffic system.

If any accident happens, then the fog nodes collect the video information about the accident and analyze its seriousness of the crash. The level of crash seriousness determines the dynamic changes in road environment. Many vehicles are not under the policy schemes, and then they are grouped into 25%, 50%, 75% and 100% respectively for simulation. In Future, Network Function Virtualization (NFV) can be integrated in VSDN for an effective rescue system.

III. PROPOSED PROTOCOL DESIGN

In General, the roads with more intersections obviously sets extreme traffic congestion. There exist different densities, velocities and distribution of vehicles at the intersections. Exchanging of data between vehicles under mobility leads to drop of packets, increased end to end delay, reliability, decreased delivery ratio and more.

A) Street Model

As shown in the Fig .2, the vehicles are crowded and even gets stop when both the end points of the street traffic lights are glowing Red signals. When both the end points of the street traffic lights are glowing Green signals, then there prevails an uniform distribution of vehicles. If each points portray red and green respectively, then the distribution of the vehicles are not uniform in nature.

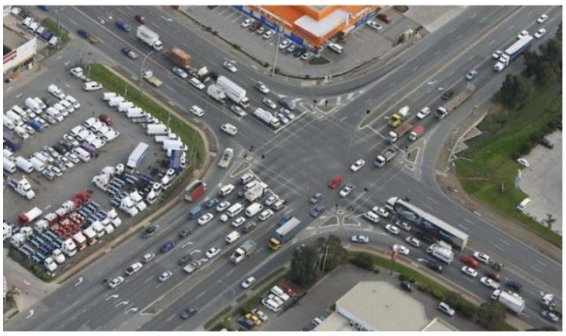
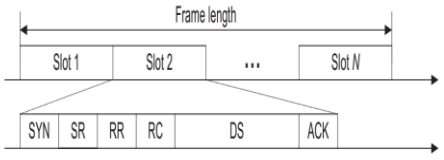


Fig:2 Traffic Intersection

B) *Soft Reservation Multiple Access with Priority Assignment (SRMA/PA)*

It supports real time and non real time integrated services of adhoc wireless networks and maximizing the multiplexing gain. Since it is TDMA based protocol, the SRMA/PA allows data transmission of any urgent vehicle without collision on an on demand fashion and the frame structure is shown in the Fig 3.



SR – soft reservation (busy tone + priority), RR – reservation request, RC – reservation confirm.

Fig:3 Frame Structure

Priority levels are assigned based on the real time and non real time services. If collision occurs in transmission, then the reservation attempt will be failed as a result the vehicles priority access will be updated based on emergency of the packets. The Prespecified priority is assigned to vehicles for both voice and data. Normally a voice application gets more priority than the data applications. The voice based systems are equipped only in emergency vehicles like ambulance where voice can be taken for communication across the vehicles around to clear the path to save many lives of people. The handshaking and reservation mechanism of SRMA/PA eliminates the hidden terminal problems. The access priorities are dynamically assigned to vehicles and gets updated which permits sharing of the channel. SRMA/PA programmed with binary exponential back off algorithm and modified binary exponential back off algorithm for non real time and real time connections respectively in case of the vehicles receives equal priority and services. The back off algorithm implements with access policy and the widow is divided for real and non real time traffic. Each Vehicle checks the difference between maximum access delay and its packets lifetime. If it exceeds the threshold value, then it selects random slots in the back off window 1 or 2 as shown in the Fig.4.This reduces the collision between data transmission amongst vehicles and increases higher connectivity.

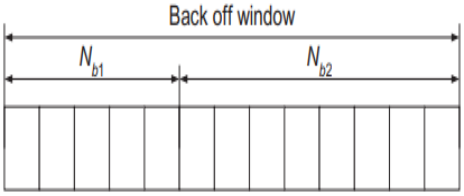


Fig :4 Back off windows

The partitioning of networks is due to non consistent distribution of vehicles in the roads by traffic lights. The data packets of any vehicle has to keep it until it serves proper communication to neighboring vehicles which shown in the algorithm 1.

Algorithm 1 SRMA/PA

Notations:
V_{sn}-The source vehicle
V_{dn}-The destination Vehicle
S_p-Delivery of packet through street
L_L-Low density area length
$P_c(n)$-Connectivity of nth street
P-Packet

1: **for** each V_{sn} packet **do**
2: **if** V_{dn} is in S_p **then**
3: Based on priority, forward P to V_{dn}
4: **else if** check the priority position of P
5: **then** forward P closer to V_{dn}
6: Based on real and non real time applications
7: Select back off window slot
8: Calculate the highest value $P_c(n)$
9: **end if**
10: **end for**

IV. PERFORMANCE EVALUATION

To measure the performance of our proposed protocol, we provide TLRC as contradictory experiments. The speed of a vehicle is defined between 30-60 km/h, in a area of 2250m*1500m which has 12 intersections and 17 bidirectional streets. Omni directional antenna employed in each vehicle where it serves the communication coverage of 250m with 2Mbps data rate. We setup this environment using the tool SUMO and MOVE along with traffic light periods 20-40sec with 300 vehicles on a single network. When the red signal timing gets increase, which in turn increase the end to end delay and decrease the packet delivery ratio. Similarly, when the number of vehicles are increased from 150-350, which creates contention window problem with decrease end to end delay and increase the packet delivery ratio.

In order to overcome the contention window problem for the number of vehicles above 300, then back off window handle its drawbacks by dynamically allocating slots with priority results in decrease in end to end delay and increase in packet delivery ratio between vehicles. Fig.5 and Fig.6 show the result of traffic light duration on packet delivery and end to end delay. Fig.7 and Fig.8 show the result of number of vehicles on packet delivery and end to end delay Compared with TLRC, our proposed routing protocol decreases the end to end delay by 25.74% and 51.5% on average, respectively and increases the packet delivery ratio by 11.69% and 23.7% on average, respectively.

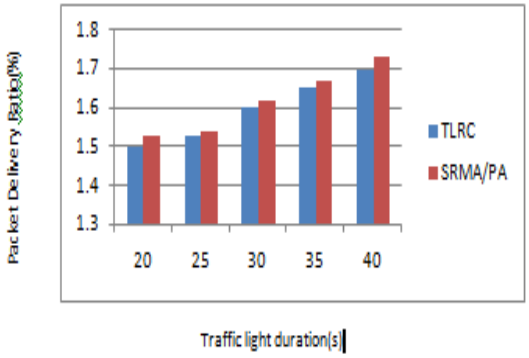


Fig:5 Traffic Light duration on packet delivery ratio

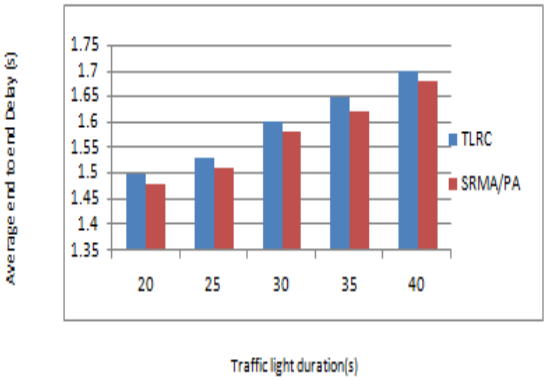


Fig:6 Traffic Light duration on end to end delay

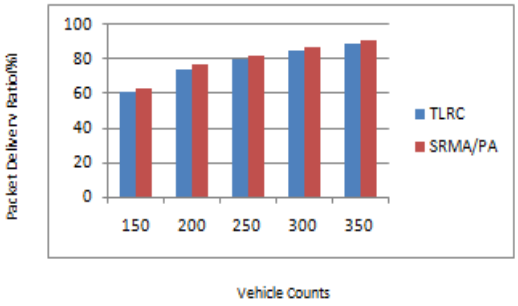


Fig:7 Vehicle count on packet delivery ratio

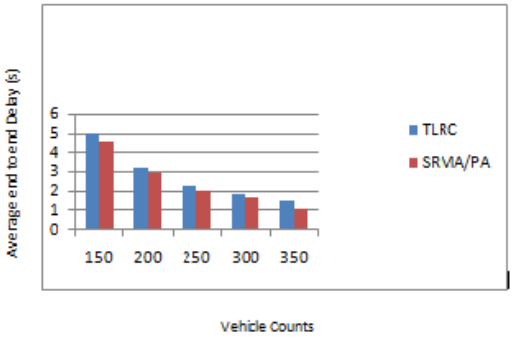


Fig:8 Vehicle count on end to end delay

V. CONCLUSION

In this article, we portrayed the connectivity of VANET under traffic light considerations. We proposed a routing protocol called SRMA/PA a contention based reservation mechanism which analyzes the traffic light effects on performance of routing and its connectivity. The existing TLRC (traffic light aware routing protocol) methodology showcased a end to end delay and the packet delivery ratio by 25.7% and 11.69% on average, respectively for not more than 300 vehicles. Simulation results clearly shown that the proposed SRMA/PA algorithm reduces the end to end delay and increase the packet delivery ratio with increased in number of vehicles from 300 and more. The future aim will be the application of secure data transfer without overload the CPU and focus on location privacy of the users across traffic areas.

REFERENCES

1. Jin-Jia Chang,Yi-Hua Li,Wanjiun Liao and Ing-Chau Chang," Intersection based Routing for Urban Vehicles communication with Traffic light considerations", IEEE Wireless Communication,1536-1284,Fabraury 2012.
2. Kartik Pandit,Dipak Ghosal, IEEE , H.Micheal Zhang, and Chen-Nee Chuah,Senior member IEEE,"Adaptive Traffic signal control with Vehicular Adhoc networks",Vol.62.No.4.00018-9545, IEEE May 2013.
3. Juan(Susan)Pan,Iulian Sandu Popa, and Cristian Borcea," DIVERT: A Distributed vehicle traffic routing system for Congestion avoidance",1536-1253, IEEE 2015.
4. Joy Chandra Mukherjee,Arobinda Gupta, and Ravella Chaitanya Sreenivas," Event notification in Vanet with capacitated Roadside Units (RSU)", 1524-9050, IEEE 2016.
5. Chang Guo,Demin Li,Guanglin Zhang and Zhaoyuan Cui," Data Delivery delay reduction for Vanets on Bidirectional Roadways", 2169-3536, IEEE 2016.
6. Qing Ding,Bo Sun,Ximming Zhang Member,IEEE, "A traffic light Aware Routing Protocol based on street connectivity for urban vehicular adhoc networks", 1089-7798, IEEE 2016.

7. Amjad Mehmood,Akbar Khanan,Abdul Hakim H.M.Mohamed,Houbing Song," ANTSC: An intelligent naïve Bayesian Probabilistic estimation practice for traffic flow to form stable clustering in VANET",2169-3536,IEEE 2017.
8. Chang Guo,Demin Li, Guanglin Zhang and Menglin Zhai." Real Time Path Planning Urban area via VANET assisted traffic information sharing", 0018-9545, IEEE 2018.
9. Armir Bujari,Mauro Conti,Carla De Francecco,Claudio E.Palazz," Fast Multihop Broadcast of alert messages in Vanet: An Analytical Model", 1570-8705,IEEE 2018.
10. Jeferson Campos Nobre , Allan M.de Souza,Denis Rosario,Cristiano Both,Leandro A.Villas,Eduardo Cerqueira,Torsten Braun,Mario Gerla," Vehicular software defined networking and fog computing integration design principles", 1570-8705, Elsevier 2018.

AUTHORS FROFILE

K.Suganyadevi, Presently working as A.P in Electronics and Communication Engineering of Sri Eshwar College of Engineering, Coimbatore, Tamilnadu, INDIA. Initially graduating in ECE department from Maharaja Prithvi Engineering College, Coimbatore, Tamilnadu, INDIA and then M.E from Karpagam University, Coimbatore, Tamilnadu, INDIA. Currently, Pursuing Ph.D in the area of wireless networks and communications under Anna University, Chennai, Tamilnadu, INDIA. Besides, 20 B.E projects supervised, Published 13 papers in International Journals , 01 in National Conference, attended 15 Workshops conducted in various Institutes. Other responsibilities i.e. Deputy IQAC head, Department Coordinator of NBA, NAAC and Governing Council of SECE. Theory /Practical Examiner and Evaluator for various Anna University affiliated Institutions. Lifetime member of ISTE.

Dr. N. SaravanaSelvam, Professor, Department of ECE, PSR Engineering College, Sevalpatti, Sivakasi. He has obtained his Ph.D. in Computer Science and Engineering from Anna University, Chennai in the year 2013. He has obtained both of his Post Graduate degree, M.E. (Computer Science and Engineering) and Graduate degree B.E., (Electronics and Communication Engineering) from Madurai Kamaraj University (Tamilnadu, India). During his twenty years of teaching profession, he shouldered a member of teaching, administrative and societal based assignments. He is a Life Member of ISTE, IAEng and IACSIT. Currently, he is specializing in the area of Network Engineering, Data Mining and IoT. He has published more than 30 papers in international journals.