Journal of Green Engineering (JGE)

Volume-10, Issue-12, December 2020

Extended Bi-Directional Stable Communication Protocol with Timer based BSSA Algorithm in VANET

[1]A. Rajalakshmi, [2] L.R.Aravind Babu,[3]R.G.Suresh Kumar

[1]Asistant Professor, Department of computer Applications, SRMIST, Kattankulathur, Tamil Nadu, India.E-mail: rajalaka@srmist.edu.in
[2]Assistant professor, Division of CIS, Annamalai University, Tamil Nadu, India. E-mail: er.arvee@rediffmail.com
[3]Associate Professor, RGCET, Pondicherry, India.

Abstract

VANETS are treated as one of the greater well-known technologies for enhancing the efficiency and protection of modern transportation schemes. The issue in SCRP (stable CDS-based routing protocol) computes the end-to-end delay for the entire routing path before sending a data message. To overcome this issue, we proposed E-BDSC (extended bi-directional stable communication) protocol with timer based Broadcast Storm Suppression Algorithm. This protocol broadcast the HELLO packets to find the link quality ratio is used to permit/restrict nodes depends upon the link as becoming the next rely node for forwarding the alert message and also it reduces the unwanted flooding of message leading to broadcast storm problem. Our analytical and experimental results show that the link quality between the source and destination has been increased with decrease in unwanted flooding/bandwidth, message loss and E2E Delay.

Keywords: ACNL List, Alert message, Bandwidth, BSSA, duty cycle, End-to-End delay, HELLO Packets, Link Quality Ratio

1 Introduction

The goal of Intelligent Transport Systems (ITSs) is to combine information

Journal of Green Engineering, Vol. 10_12. 13662-13672.

and communication technology with transport systems in order to build more competent, green, safe and smooth transport systems. To accomplish both vehicle-to-infrastructure (V2I) and vehicle-to-vehicle (V2V) communications, the ITSs are based on wireless technologies. Vehicles communicate with a defined movement through the wireless media in V2I communication. In the other hand, wireless contact responses are given in the V2V access vehicles to converse specifically with neighbouring vehicles without the need for any infrastructure. Vehicles with V2V potential form an ad hoc network, commonly known as an ad hoc vehicle network (VANET).

Each vehicle must also be able to transmit, receive and communicate security or infotainment information in the VANET[2] in V2V. When opposed to V2I networks, since they run without fixed access network nodes, VANETs have ever-present knowledge exchange and their usage implications at lower execution costs. VANETs can utilize numerous wireless networking technologies as their base. Small-range radio systems such as WLAN (either standard Wi-Fi or IEEE 802.11p unique to the vehicle), Bluetooth, Visible Light Communication (VLC), Infrared, and ZigBee are the most common. In addition, VANETs will support cellular technologies such as UMTS, LTE, or WiMAX IEEE 802.16, forming heterogeneous vehicular networks.

The function of VANET is to permit wireless communication between on-road vehicles along with wireless sensors on the roadside, to facilitate the transport of information in order to guarantee driving safety and to prepare for dynamic routing, to allow mobile sensing and also to provide in-car entertainment.

Every participating vehicle is converted into a wireless router or node by A VANET, permitting cars to communicate within 100 to 300 metres of each other and, in turn, form an extensive-range system. In order to establish a mobile Internet, as cars drop out of the signal collection and fall out of the system, remaining cars can assist in linking vehicles to each other. The vehicles and roadside elements are the conversing nodes in vehicular communicating system, presenting each other with data, such as protection warnings and traffic intelligence. The vehicular communication structures can be further efficient in stopping accidents and traffic congestions than if every vehicle strives to resolve these issues independently. There are three factors parts of the VANET: Onboard unit (OBU), Roadside unit (RSU) and the backhaul network [3].

2 VANET

VANETs have special characteristics including complex topology, regular network disconnection and diverse communication environments, conventional MANET routing protocols such as Ad hoc On-Demand Distance Vector (AODV) (Perkins and Royer, 1999) are not specifically available for VANETs.

2.1 Characteristics

Over the last few years, VANETs have passed into a main study portion. In contrast with other styles of MANETs, VANET has its own unique characteristics and the different characteristics of VANET[3] include:

- *Predictable mobility*: Separate MANETs, VANET network nodes (here vehicles) go in a predetermined manner as route structure is developed and vehicles are required to navigate and follow road signs, road signals and other moving vehicles[8].
- *High mobility and rapid changing topology:* In particular, on roads and highways, vehicles go very fast. Therefore, for a very short period, they remain within each other's contact range, and connections are identified and broken rapidly, resulting in rapid transformation in network topology. In addition, the action of the driver is damaged by the need to respond to input obtained from the network, creating variations in the topology of the network. The incremental changes in the topology of the network impact the network diameter to be negligible, although some routes can be disconnected before they can be used.
- *Geographic position available:* Fresh, accurate positioning systems integrated with electronic maps can be distributed to cars. For example, in cars that assist to give position information for routing functions, global positioning system (GPS) receivers are incredibly common.
- *Variable network density:* The reliability of the VANET network varies according to the traffic load, which in the traffic jam event, such as in rural places, can be very high or very low.
- *High computing capacity:* Because vehicles are VANET nodes, sensors and sufficient communication tools such as high-speed processors, large processing space, sophisticated antenna technology and contemporary GPS will carry a satisfactory amount. These tools improve the node's computing capacity, which helps to establish efficient wireless communication and collect accurate node location, speed and direction information.

2.2 Challenges

Largest obstacles [2]. The basic characteristics of VANETs involve distinct communication paradigms, protection and privacy techniques, and wireless communication systems compared to MANETs.

- *Fundament Limits and Opportunities: T*he key limits and opportunities of VANET contact from a more analytical viewpoint are unexpectedly marginally understood.
- *Standards:* The original IEEE 802.11 specification is not capable of complying well with the prerequisite of stable network access, and the new IEEE 802.11p protocol MAC specifications are not professionally designed for a likely significant amount of vehicles.

- *Routing Protocols:* While many efficient routing protocols and algorithms like cognitive MAC for VANET (CMV) and greedy traffic-aware routing (GyTAR) [2] have been introduced by researchers, the crucial challenge is to suggest good routing protocols for connectivity with VANETs with enormous vehicle mobility and elevated complex topology.
- *Connectivity:* The most critical thing for VANET connectivity is the authority and management of network links between vehicles and network infrastructures.
- *Cross-Layer:* To direct the functions of real-time and multimedia, the proposed cross-layer between original layers is an available solution.
- *Cooperative Communication:* The authors regard the VANETs as a form of cloud called the Mobile Computing Cloud (MCC) and present in vehicular communication a broadband cloud in the authors.
- *Mobility:* That is the norm that lets the topology change rapidly for vehicular networks[8]. Similarly, there are strong similarities between the mobility habits of automobiles on similar routes.
- *Security and Privacy:* There are several alternatives that have big pitfalls, and the mainstream approach is still focused on "key pair/certificate/signature."
- *Validation:* In a real situation, it is important to not only test the output of VANETs, but also to determine previously unknown and vital device properties.

2.3 Applications

Performance and protection are two significant criteria that can be used, based on their core concept, to categorise VANET applications [2]. Yet, efficiency and protection are not completely isolated from each other. In the other hand, in the design of VANET applications, these and other characteristics should be measured together.

- *Safety Applications:* The definitive aim of the safety features of VANETs is to avert and reduce the number of road injuries. This is a delay-susceptible functional level. Thus, in order to reduce the delay, systems use vehicle-to-vehicle connectivity in this category.
- *Efficiency Applications:* This is a group where functions are mindful of the location of the car aimed at restoring their mobility on public roads. In this class, most applications need optimum availability, since drivers require the data generated to deliver results during the journey, rendering the journey smoother.
- *Comfort Applications:* Drivers can get input from vehicle resources in this class that can support the driver on the journey, making it more comfortable and pleasant.

- *Interactive Entertainment:* Aspiring to question and bring entertainment-related data to drivers and travelers, networking and usability are the key features of this practical class.
- *Urban Sensing:* As a network model for urban exploration and the exchange of knowledge of natural interest, a vehicular network can be used. This is particularly true in urban environments, where a high concentration of cars can be assumed to be prepared with on-board sensors.

3 Related Work

In this area, we check at VANET's current routing suggestions and then consider the problem of using such protocols in the vehicle context, particularly in urban situations. Some of the protocols are: RBVT [6]. These protocols benefit from real-time vehicle traffic information in order to construct route-based pathways composed of sequences of road intersections that are extremely likely to have network connections between them. Geographical assistance is used to pass packets on the path between intersections, minimizing the vulnerability of the path to the motions of individual nodes. We optimise the forwarding for crowded networks with high contention using the dispersed receiver-based option of next hops based on a multi-criterion preference purpose that takes into account non-uniform radio propagation. GPSR [5], in network topology, it allows greedy forwarding choices using only knowledge about the immediate neighbours of a router. The algorithm recovers when a packet attains a position where greedy forwarding is difficult, by routing across the perimeter of the area. As a number of network destination rises, GPSR range grater in per-router state than shortened-path and ad-hoc routing protocols, by retaining state only about the local topology. GPSR can use local topology knowledge to easily identify right new routes under continuous mobility topology changes. We define the GPSR protocol and equate its achievement with that of Dynamic Source Routing using broad simulations of mobile wireless networks. Greedy Traffic Aware Protocol for routing optimal for metropolitan environments, GyTAR [4]. GyTAR have couple of parts: I choose the links through which a packet must pass dynamically in order to attain its target and (ii) use an enhanced greedy system to transfer packets between two junctions. In this article, we offer a comprehensive report of our approach and provide its additional advantages compared to other current vehicle routing protocols. In terms of packet distribution ratio, end-to-end latency, and routing overhead, these findings indicate major efficiency changes. Given the extremely mobile, partitioned existence of these networks, MDDV [9] is a mobility-centric means of data diffusion in vehicular networks intended to function accurately and reliably. MDDV is intended for the data dissemination of adventure vehicle mobility and incorporates the concept of opportunistic forwarding, trajectory-based forwarding and regional forwarding. For the implementation of localized algorithms in vehicle networks, we are creating a generalized mobile computing approach. Based on their own experience, vehicles conduct local operations while collectively achieving a global behavior.

4 E-BDSC Protocol with Timer Based BSSA Algorithm

This section contains Network formation, Broadcasting HELLO packets, Link Quality Estimation, Maintaining ACNL List.

- *Network Formation:* In the network topology of modern metropolitan areas, the network representation comprises of roads and junctions. There are distinctive features for each road section, such as length, width, number of lanes, and traffic density. The road segment is connected via a duplex wired link and placing the number of nodes in each direction. The Link quality ratio (LQR) is estimated by broadcasting the HELLO packet to each and every node. The alert message is transferred between the source and destination is done by using the concept of ACNL techniques.
- *Broadcasting HELLO packet:* In this section, The HELLO packet is transmitted to each and every node in the network topology for finding the LQR. This packet (ie., ID, POSITION and ACNL LIST) is received only when the node is in alive state and after some time it goes to sleep state so the bandwidth is reduced by using this duty cycle concept(BSSA with timer based technique) [1]. Figure 1 shows System Architecture. Figure 2 shows Broadcasting HELLO packets.

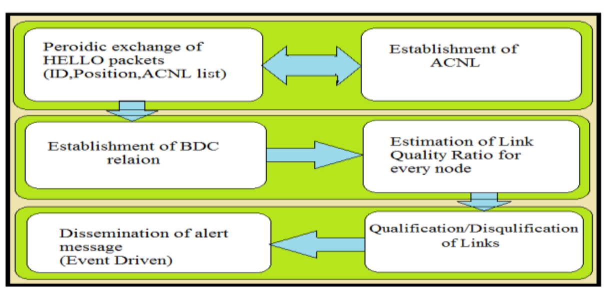


Figure 1 System Architecture

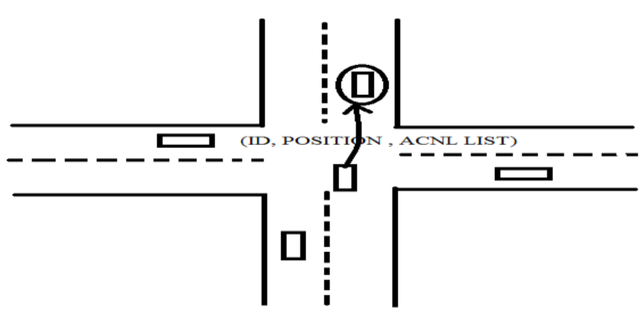
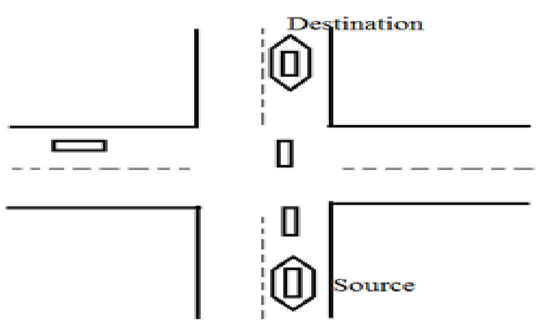


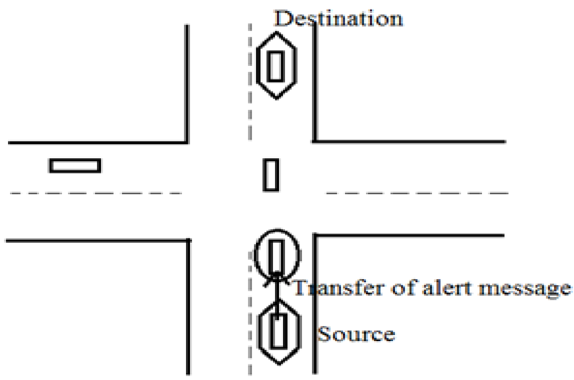
Figure 2 Broadcasting HELLO packets

- *Link Quality Estimation:* A distributed warning signalling protocol that specifically selects a collection of possible relay nodes is the E-BDSC protocol. A significant evaluation of the consistency of each relation between a given pair of nodes is provided by the link quality inference algorithm. Furthermore, two link selection criteria based on significant estimates of the link merits are proposed [7]. The efficiency of the collection of relay nodes by concentrating only on those nodes with an appropriate quality of links to prevent the loss of warning signals and thereby increase the accessibility of alert signals within a platoon of vehicles. The increase in reachability is accomplished when retaining a low latency in communication from end to end. The quality of link is estimated by using the receiving signal strength ie., If the packet is received properly then the quality of link is high (Strength) otherwise it is low (Weak).
- *Maintaining ACNL List:* The exchanging of HELLO packets outcomes in the development of a list of active nodes of communication (ACNL)[10]. As a consequence of using the node IDs derived from the obtained HELLO packets, the ACNL is created locally at each node, where the maximum number of ACNL entries is constrained by the size of the HELLO packets. If a HELLO package is got from node A at node B, taking into consideration two nodes A and B, node B informs its ACNL by setting the node A ID as presently working in single-hop communication, and conversely is right. The loss of node A by HELLO packets, on the other hand, will result in the lack of node A ID access in the ACNL of node B. If the ACNL is recognized, it is integrated into the subsequent planned HELLO packet for transmit and sent to its neighbouring nodes.

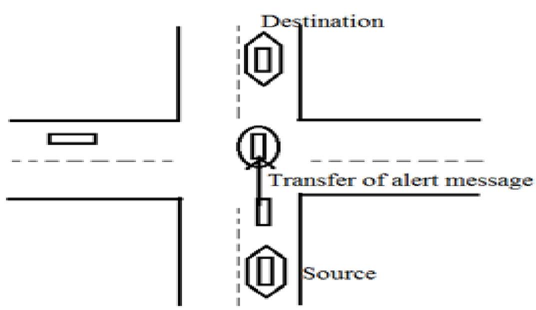
The data contained within each HELLO packet includes the ID of the broadcast node, the positioning coordinates and the ACNL. Any specific identifier, such as the MAC address of the IEEE 802.11-based wireless transceiver, will represent the Broadcaster ID. The BDC flag is used for checking whether the ID of intermediate node is present in both the ACNL list of source and destination. If the flag is true then the alert message is transferred between them or else it will not transfer the alert message through that path.



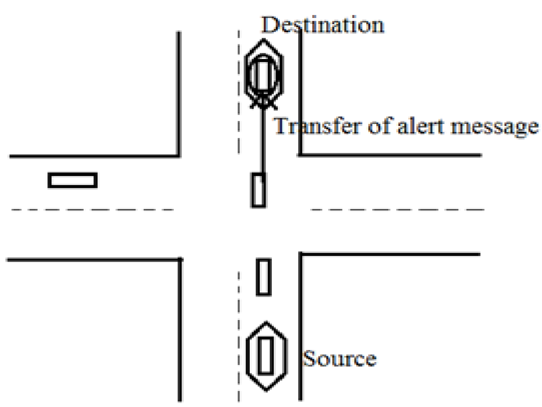
(A)



(B)



(C)

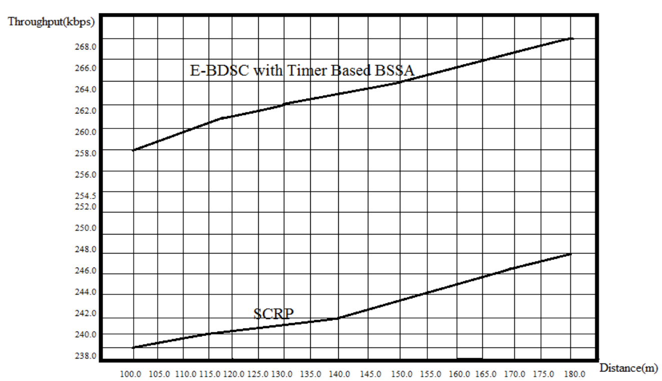


(D)

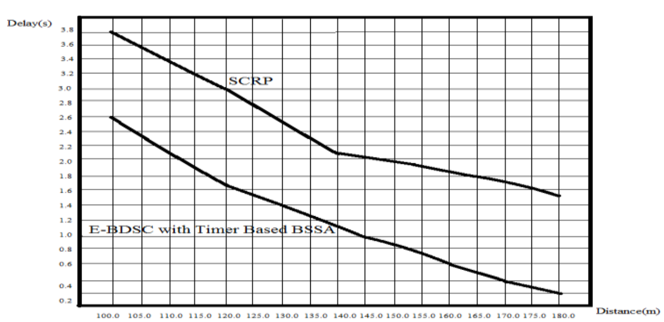
Figure 3 Source sends Alert message to Destination. (a) Source and Destination are labeled (b) Source sends a message to 1st transitional node (c) 1st transitional node sends a message to 2nd transitional node (d) 2nd transitional node sends a message to Destination

5 Performance Evaluation

- *Packet Delivery Ratio:* When compared to SCRP, our protocol improves the packet delivery ratio. SCRP evaluates 238.0 packet delivery ratio at distance of 100 meters and 248.0 Packet delivery ratio at distance of 180 meters. Our proposed protocol improves by performing 258.0 Packet delivery ratio at distance of 100 meter and 268.9 Packet delivery ratio at distance of 180 meters. Thus the result shows that E-BDSC Protocol with Timer based BSSA concept increases the Packet rate.
- *End-to-End Delay*: As a function of the number of cars, Fig. 4(b) illustrates the average end-to-end delay. We note that all protocols tend to minimise E2ED as the density of the network increases. When compare to SCRP, We also observe that E-BDSC incurs the smallest E2ED as it eliminates the Backbone and bridge node. The X-graph for SCRP protocol shows that 3.8 delay at 100 meters and 1.5 delay at 180 meters while E-BDSC protocol shows that the 2.6 delay at 100 meters and 0.2 delay at 180 meters.



(A)



(B)

Figure 4 Comparison of SCRP and E-BDSC with Timer Based BSSA (Distance vs. Throughput and Delay) (a) Total Throughput (b) Average End-to-End Delay.

6 Conclusion and Future Enhancement

In this work, we proposed a routing protocol for VANET in urban scenarios, called E-BDSC. This protocol extracts the information to enhance the stable path between source and destination using a link quality ratio. To do so, it started by broadcasting the HELLO Packets to every nodes in the global topology. This ratio which is used to permits/restricts the nodes depending upon the quality of link as becoming the next reply node for forwarding the alert message. The unwanted flooding of broadcasting message is reduced using the BSSA with timer based concept. Thus the result show that E2E delay, message loss, and unwanted flooding/bandwidth is decreased with increase in throughput when compared to SCRP.

Our analytical and experimental results show that the link quality between the source and destination has been increased with decrease in unwanted flooding/bandwidth, message loss and E2E Delay. Future work contains investigation in numerous directions based upon the reliability of alert message between source and destination. The reliability can be increased by using Reliability based routing protocol. This work also needs to improve the security of alert message by using Secure Message Transmission protocol.

References

[1] Chitra M and Siva Sathya S, "Issues And Challenges In Broadcast Storm Suppression Algorithms Of Vehicular Ad Hoc Networks" Informatics Engineering, an International Journal (IEIJ), Vol.3, no.2,pp.11-27, 2015.

[2] Felipe Domingos da Cunha, Azzedine Boukerche, Leandro Villas, Aline Carneiro Viana, Antonio A. F. Loureiro , "Data Communication in VANETs: A Survey, Challenges and .Applications", Ad Hoc Networks, 2014.

[3] Humayun Kabir Md., Research Issues on Vehicular Ad hoc Network", International Journal of Engineering Trends and Technology" (IJETT) – Vol. 6, no. 4.pp.174-179, 2013.

[4] Jerbi M, Senouci S.-M., Meraihi R., and Ghamri-Doudane Y, "An improved vehicular ad hoc routing protocol for city environments", IEEE International Conference on Communications, pp. 3972–3979, 2007.

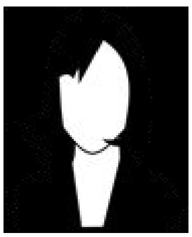
[5] Karp B and Kung H T, "GPSR: Greedy perimeter stateless routing for wireless .networks", Proc. 6th Annu. Int. Conf. MobiCom Netw., pp. 243–254, 2000.

[6] Nzouonta J, Rajgure N, Wang G, and Borcea C, "VANET routing on city roads using real-time vehicular traffic information", IEEE Trans. Veh. Technol., Vol. 58, no. 7, pp. 3609–3626, 2009.

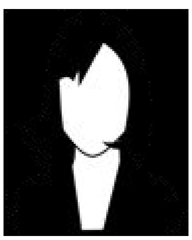
[7] Jothi Kumar.c,R.Karthikeyan, "Improved reputation system for wireless sensor networks (WSNS)",International journal of innovations in scientific and engineering research (IJISER), Vol.1,no.3,pp.191-195,2014.

[8 Sumo: Simulation of Urban Mobility,Available online : https://en.wikipedia.org/wiki/Simulation_of_Urban_MObility
[9] Wu H, Fujimoto R, Guensler R, and Hunter M, "MDDV: A mobility centric data dissemination algorithm for vehicular networks," Proc. 1st ACM Int. Workshop VANET, pp. 47–56,2004.
[10] Osama M Hussain Rehman, Mohamed Ould-Khaoua, Hadj Bourdoucen., "Link quality estimation in VANETs for multi-hop alert messages dissemination",Vol.15,no.4,pp.313-335,2015.

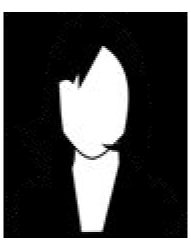
Biographies



A.Rajalakshmi, Asistant Professor, Department of computer Applications, SRMIST, Kattankulathur,Tamil Nadu, India



L.R.Aravind Babu, Assistant professor, Division of CIS, Annamalai University, Tamil Nadu, India.



R.G.Suresh Kumar, Associate Professor, RGCET, Pondicherry, India.