International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 03 Issue: 08 | Aug-2016 www.irjet.net p-ISSN: 2395-0072

Fast and Efficient Routing Mechanism for VANETs

Shubhangi Rangnath Ingle

M.E. Student,Department of Computer Engineering, K.J.Somaiya college of Engineering, Maharashtra, India,

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Abstract - ***Vehicular ad hoc networks (VANETs) allows vehicles to communicate with each other but require fast and efficient routing mechanism for their success. Objective of this paper is to exploit the infrastructure of roadside units (RSUs) to efficiently and reliably route packets in VANETs. Our system operates by using vehicles and RSUs to route the packets from source vehicle to destination vehicle. If distance between source vehicle and destination vehicle is less, then packets are directly sent to destination vehicle, otherwise if distance is more, packets are routed through RSU network. We named the system as "Can Send".***
Literature survey is done on Vehicular Ad-hoc Networks and road side units shows that a lot of work is being carried out in the field of Vehicular Ad-hoc Networks and RSUs to improve the communication among on road vehicles. "Can Send" is simulated using ns-2 network simulator using tcl scripting language.
Key Words: **Vehicular Ad hoc Networks (VANETs), Road Side Units (RSUs), Can Send, Source(S), Destination (D), Packet (P)**

1. INTRODUCTION

Vehicular Ad hoc network allows moving vehicles to communicate with each other for safety and comfort. In VANET communicating nodes are moving vehicles, and sending packets to moving object is the challenging task. As RSUs are fixed infrastructure, by using RSUs to route the packets will make the routing easier as sending packets to fixed location is easier than sending packets to moving objects.

2. PROBLEM DEFINITION

In VANET communicating nodes are moving vehicles. Due to mobility of vehicles routing packets through VANETs is challenging task. To address this challenge "Can Send" uses Road Side Units to route the packets.
In "Can Send" RSUs with distance less than 2000m are called as neighbor RSUs. RSUs can directly send packets to their neighbor RSUs. RSUs forward packets to destination vehicle. Using RSUs that is fixed infrastructure, the packet delivery ratio and throughput is increased as compared with without using RSUs. scenario Also with using RSUs routing overhead is reduced as compared with without using RSUs scenario.

3. PROPOSED SYSTEM

A vehicular ad hoc network (VANETs) allows vehicles to communicate with each other but as vehicles are highly mobile, routing packets in VANETs becomes very challenging task. In this paper, we exploit the infrastructure of Road Side units (RSUs) to efficiently route packets in VANETs. "Can Send" operates by using RSUs in addition to vehicles to route the packets from source vehicle to destination vehicle. In "Can Send" RSUs with less than 2000m distance are set as neighbor RSUs, and can directly send packets to neighbor vehicles. "Can Send" is very useful for users who are far apart and want to communicate using their vehicle's onboard units. "Can send" will greatly benefit to social networks, to enable users on the road to exchange information.

4. ADVANTAGES OF "CAN SEND"

1. The result proves the feasibility and efficiency of "Can Send"
2. "Can Send" operates by using RSUs in addition to vehicles to route the packets from source vehicle to destination vehicle.
3. Addresses the connectivity issues such as void regions and unavailability of forwarders.

5. WORKING OF "CAN SEND"

5.1 System Architecture1

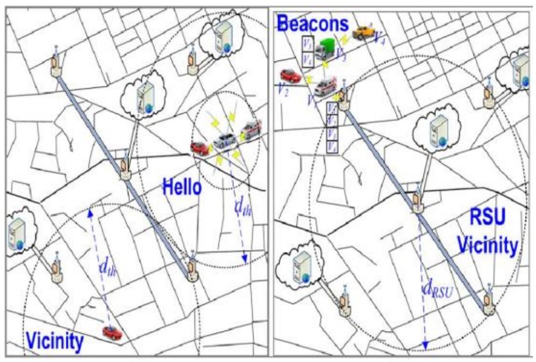

Fig -1: (a) vehicles vicinity & HELLO packets,(b) RSU vicinity and beacons [1]

Each vehicle sends Hello packets to vehicles in its vicinity which contain its location, speed, direction and time stamp (LSDT). Time stamp allows the entry to be deleted after specific time period. When any vehicle receives Hello message from its neighbor vehicle, it adds its own location, speed, direction and time stamp to that Hello message if the distance between itself and sender of Hello message is less than its vicinity threshold and forwards it to its neighbors. So list L of vehicles in every vehicle's vicinity is built as every vehicle adds its LSDT to the Hello message and forwards it to its neighbor vehicles. Fig. 1(a) shows an example of the vicinity of a vehicle.

Similar to Hello message every vehicle sends beacons to their nearest RSU. Beacons also contain location, speed, direction and time stamp. Fig.1 (b) shows the RSU vicinity and beacons. From the beacons received from vehicles, RSUs maintain Hash table which contains the vehicle IDs and their current RSU. Every RSU maintains Hash Table. Two RSUs are known as neighbor RSUs if distance between them is less than 2000m. Example :If any source vehicle S wants to send packet P to destination vehicle D. S checks vehicle D's entry in its list L to check if it is present in its vicinity. If D is present in L, then number of hops (h) is calculated by dividing the distance between S and D by its transmission range. Then packet P is directly sent to D after setting time to live (h+hs), where hs is additional hops added to increase the reliability. If D is not present in source vehicle's list L, then S forwards P to its nearest RSU R1. R1 uses hash function H (D) to get the current RSU R2 of D. After getting current RSU R2 of destination vehicle, R1 sends packet to R2 by the route which is already known to R1 (As RSUs have fixed locations, routes of RSUs are already known). The distance between R2 and D is divided by its transmission range to calculate number of hops (h). Then R2 sends packets to D after setting time to live (h+hs) hs is additional hops added to increase the reliability.

5.2 Vehicle Updation by RSUs

Each vehicle sends periodic beacons to its nearest RSU. Beacon contains vehicle IDs, its current location in the form of coordinates of vehicles and the direction of the vehicle. Vehicle checks the distance between Vehicle itself and RSU if the distance between RSU and vehicle is less than 500m then the RSU is set as its current RSU of vehicle. Beacons are sent periodically. Similarly vehicle updation takes place periodically.

5.3 Neighbor Calculation

In neighbor calculation each RSU calculates the distance between itself and every other RSU, if the distance between two RSUs is less than 2000 m then RSUs are called neighbors of each other. Each RSU can directly send packets to its neighbor RSU. RSUs are connected by wireless connection.

5.4 Communication between Requested Nodes

When a source vehicle wants to send packets to destination vehicle it gets the coordinates of destination vehicle from its list L. It gets the location of destination vehicle from the last beacon sent by destination vehicle. It calculates the distance of destination vehicle. If the distance between source and destination is less than 500m then source vehicle directly sends packet to destination vehicle. If the distance between source vehicle and destination vehicle is greater than 500m and less than 2000m then packets are routed through one RSU. And if the distance between source vehicle and destination vehicle is greater than 2000m then packets are routed through multiple RSUs. Figure 2 shows the flow chart of "Can Send" in detail.

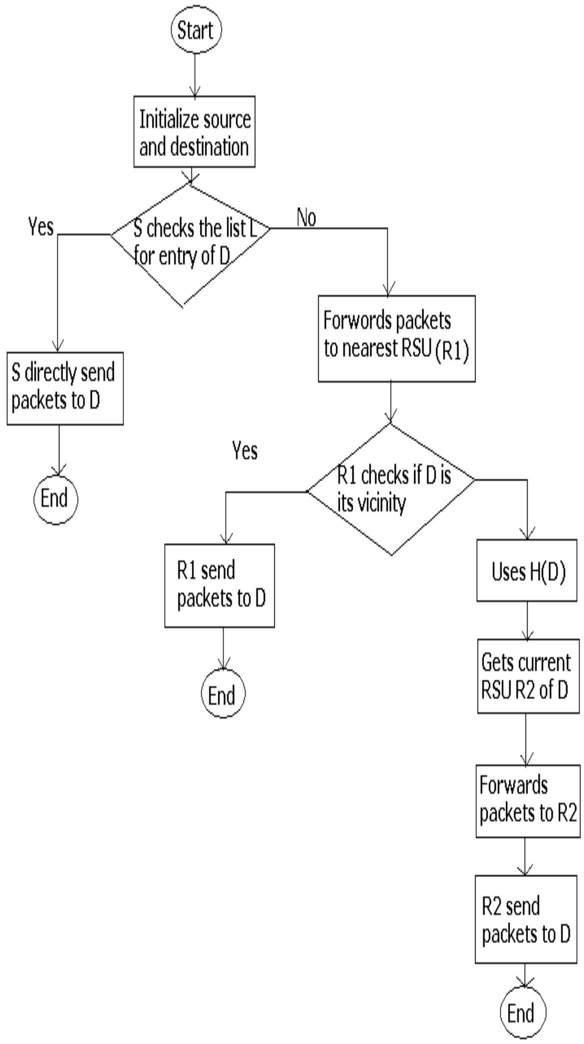

Fig -2: Flowchart of "Can Send"

6. RESULTS

Performance of "Can Send" is evaluated on the following performance metrics:

1. Packet Delivery Ratio
2. Throughput
3. Routing Overhead

6.1 Packet Delivery Ratio

Packet delivery Ratio is ratio of number of packets received by destination vehicle to total number of packets send by source vehicle. Fig 3 shows the graph of comparison of PDR with using RSUs and without using RSUs.

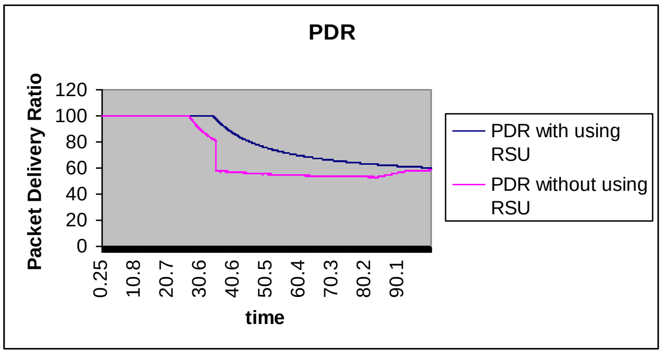

Fig -3: Comparison of PDR with using RSUs and without using RSUs

6.2 Throughput

Throughput is number of packets delivered at destination per second. Fig 4 shows comparison of throughput of with using RSUs and without using RSUs.

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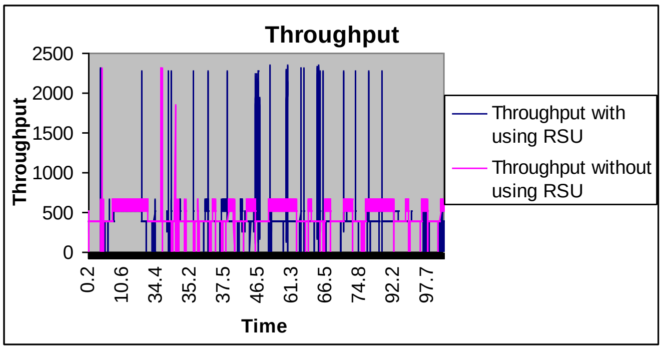

Fig -4: Comparison of throughput of with using RSUs and without using RSUs

6.3 Routing Overhead

Routing overhead is ratio of number of control packets to actual number of packets sent. Fig 5 shows comparison of routing overhead for with using RSUs and without using RSUs.

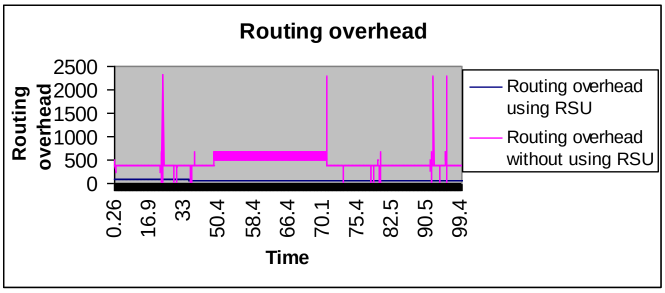

Fig -4: Comparison of routing overhead of with using RSUs and without using RSUs

7. CONCLUSIONS

"Can Send" makes the use of RSUs which are fixed infrastructure to route the packets to destination vehicle. It is demonstrated that with using RSUs PDR and throughput increases as compared with the PDR and throughput without using RSUs. Also with using RSUs routing overhead is reduced as compared with the without using RSUs. Thus "Can Send" can be called as fast and efficient routing mechanism for VANETs.

ACKNOWLEDGEMENT

I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this project. A special thanks to my project guide, **Mr. Prasanna Shete**, whose help, stimulating suggestions and encouragement helped me to complete this project. I am grateful to our Principal **Dr. Shubha Pandit** for making all the resources available for the successful completion of this project. Many thanks go to the head of the department, **Mrs. Bharathi H.N** who have given her full effort in guiding me.
Last but not the least, I am thankful to all those who helped me directly or indirectly in completion of this project.

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