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Routing protocol for intermittent connected VANET by using real time traffic information system

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Abstract

Recently wireless technologies and short-range data communications have made inter-vehicular communications and road vehicle communications practically realizable in mobile ad-hoc networks (MANETs). This development has contributed a new applications in the MANET called as the vehicular ad hoc network (VANET). Internetworking in the VANET systems has achieving a great amount of momentum in past four to five years. Its importance has been significantly accepted by many car manufacturing industries, governmental organizations, defense applications, and in the academic community. This work is focused on routing protocols that basically refers to road based using vehicular traffic (RBVT) routing which generally based on a class of routing mechanism and it has outperformed over existing routing protocols in city-based high probability, vehicular network connectivity among them. We are demonstrating results for Vehicular ad hoc network (VANET) which are suffering from intermittent connectivity problems due to vehicles mobility, which challenge routing protocols. To address the issue, we propose a novel strategy that consists of a composite scheme having applications of Reactive Pseudo-suboptimal path Selection routing protocol (RPS) in the RBVT routing protocol during the intersection mode route selection problems.

Keywords:- connectivity packets (CPs), Intermittent, mobile ad-hoc networks (MANETs), road based using vehicular traffic (RBVT), Reactive Pseudo-suboptimal-path Selection routing protocol (RPS) .

1. INTRODUCTION

Vehicular ad-hoc networks (VANETs) have recently received significant interest for improving road safety and drive convenience. For example, a vehicular network can Propagate warnings to drivers behind a traffic accident to avoid multiple vehicle collision. In another example, VANETs can prevent traffic jam by coordinating real-time traffic flow. As more and more vehicles are equipped with wireless communication devices, VANETs can be envisioned in foreseeable future. Although being a subclass of mobile ad hoc networks (MANETs), VANETs have distinguished features from other ad hoc networks, such as wireless sensor networks (WSNs) and delay tolerant networks (DTNs)[1][2]. Safety systems may intelligently disseminate road information, such as incidents, real-time traffic congestion, high-speed tolling, or surface condition to vehicles in the vicinity of the subjected sites[3][4]. This helps to avoid platoon vehicles and to accordingly improve road capacity. With such active safety systems, the number of car accidents and associated damage are expected to be largely reduced VANETs manifest dynamic topology and intermittent connectivity due to high mobility of vehicles [5]. Vehicular ad- hoc network(VANET) are suffering from intermittent connectivity problems due to vehicles mobility, which challenge routing protocols. To address the issue, we propose a novel strategy that consists of a composite scheme having applications of Reactive Pseudo-suboptimal-path Selection routing protocol (RPS) in the RBVT routing protocol during the intersection mode route selection problems [6].

1.1 Description of RBVT Protocol: Geographical forwarding allows the use of any node on a road segment to transfer packets between two consecutive intersections on the path, reducing the path's sensitivity to individual node movements, which we call road-based using vehicular traffic (RBVT) routing protocol[7].

We present two RBVT protocols: 1) a reactive protocol RBVT-R and 2) a proactive protocol RBVT-P. RBVT-R discovers routes on demand and reports them back to the source, which includes them in the packet headers (i.e., source routing). RBVT-P generates periodical connectivity packets (CPs) that visit connected road segments and store the graph that they form [8]. This graph is then disseminated to all nodes in the network and is used to compute the shortest paths to destinations [9]. Our initial simulations with an IEEE 802.11 VANET showed that, when the wireless medium becomes congested, the overhead introduced by the periodic "hello" packets for maintaining the list of neighbors in geographical forwarding significantly degraded the end-to-end data transfer performance.

1.2 Description of RPS Protocol:

In this section, we will describe the presented RPS protocol in detail. RPS is an anchor-based routing protocol for intermittent connectivity scenarios in VANETs. Its purpose is to select a radio-forwarding path as much as possible. There are three modes in RPS. The intersection selection mode will start when a packet reaches an intersection node. The segment mode is utilized to transmit packets on the segment. The last one is RPS mode. Once the node-disjointed problem appears, it will enable the recently passed intersection to renew a path selection from the remaining road segments. Unlike the existing solutions where packets are only carried by vehicles, RPS increases the probability of forwarding through wireless channels in intermittent connectivity scenarios

1.2.1Assumption

Location information is necessary for position based routing protocols. Thus we suppose vehicles realize its location by GPS devices, which are popular in cars. The ideal hello scheme and location management system are used to obtain information of neighbor and destination vehicles

1.2.2 Intersection Mode

RPS adopts the anchor-based idea that the packet is delivered along road. The road segment is dynamically selected one by one. Once a node lying in an intersection receives a packet, it will calculate a weight for each neighboring road segment. The segment with the highest weight is considered as the optimal path. Then the node delivers the packet to neighbor on this segment

1.2.3 Segment Mode

If a packet travels on a road segment, the segment mode will work. An improved greedy forwarding algorithm is adopted to deliver the packet in this mode

1.2.4 RPS Mode

RPS mode will be utilized if there is no next-hop according to the segment mode, which means intermittent connectivity problem happens. Then the current node will store and carry the packets.

2. ERBVT (Enhanced RBVT)

We have developed an algorithm for routing protocol based on RBVT (Road-based using vehicular traffic). This algorithm is further extended in to ERBVT(RBVT – RPS) protocol for improving the performance of our average packet delivery ratio with minimum delay, by using a predefined weight factor taken similar to the intersection mode of RPS (Reactive Pseudo-suboptimal-path Selection routing protocol) protocol related packet delivery To address the issue, we propose a novel strategy that consists of a composite scheme having applications of Reactive Pseudo-suboptimal-path Selection routing protocol (RPS) in the RBVT routing protocol during the intersection mode route selection problems. It is different from existing solutions which rely on vehicles physical movement to carry packets in intermittent connectivity scenarios. RPS gives the recently passed intersection a chance to select a new path from suboptimal-path unilaterally determined by local knowledge and its intersection mode is helpful during the case when there is more than supporting connected paths at an intersection. This mode gives an optimal path on the basis of weight factor and path connectivity. In this way by using RPS protocol in RBVT this work shows that the proposed RPS has higher packet delivery ratio and lower end-to-end delay.

3. METHODOLGY

3.1 RBVT PROTOCOL

Initially we have assume that there is an vehicular network having 8 intersections I1-I8 ,
and it has random no of vehicles on each segments formed by connecting different inter sections, the maximum possible segment are given as:
I1-I2, I2-I3 , I3-I5, I4-I5, I5-I8, I4-I7, I2-I4 , I1-I6, I6-I7, I7-I8 . In this figure each segment is shown by solid lines and different intersections are shown by circles. In this way the intersections are different node of the graph and each segment is the branch of the graph. The square shapes scatter on different segment to represent the vehicle on these road segments. n_s and n_d are the source and destination of the vehicles .

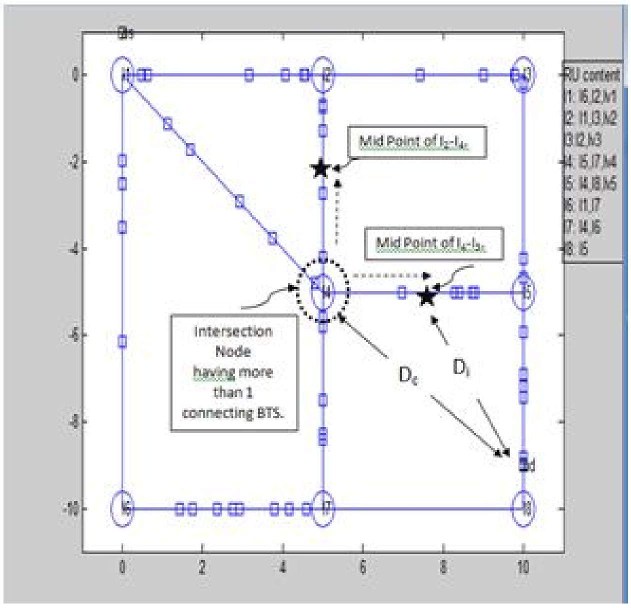

Fig: 1.: Roadmap for RBVT and for ERBVT (RBVT-RPS)

The BTS is the main controlling unit that has a information of all the neighbouring intersections with respect to the current BTS intersections gives as I_{all}. It also has information of the connected intersections and non connected intersections as I_c and I_{nc} . It also stores the information of no. of vehicles on all the segments which are formed by the BTS with the connected intersections given as V[10].

Cp Generation **:** The position of vehicles is totally random and they changes on running the algorithms every times, each nodes and BTS has the connectivity packets Cp which consists of following information.

Cp perimeter- it represent maximum allowable range of packet transmission.
Cp stack- it preserve the information of all the segments through which packet is forwarded from source to destination.
Cp states- this information is either R or U. It represent that which of the segments are reachable(R) or unreachable (U).
Data Assessment**:** From the Cp packet information each node can access the information of the connected and non connected segments and no. of vehicles in each connected segments. For instant if
Cp. states = (" R R U R R R U U R R U")
Then it indicates that 1,2,4,6,9,10 are reachable and remaining are unreachable. In this way the connected segments list is for above Cp. states are given below List of connected road segments are: [(1,6) ,(1,2) ,(2,1) ,(2,3) ,(3,2) ,(4,5) ,(5,4) ,(4,7) ,(5,8) ,(6,7) ,(6.1) ,(7,4) ,(7,6) ,(8,5)].
List of non connected road segments are: [(1,4) ,(4,1) ,(2,4) ,(4,2) ,(3,5) ,(5,3) ,(7,8) ,(8,7)]
Number of vehicles in connected and non connected segment = [4,6,6,3,3,5,5,5,6,8,4,5,8,6].

The total no. of vehicles are 50 (including connected and non connected both road segments.
The source is assumed as location (x, y) = (0, 1).
The destination is assumed as (x, y) = (10, -9).
: Initially from the information of each vehicles positions and all the BTS position distance between the source node with every intersection BTS is calculated, this distance is used to gather the information of the nearest BTS to the source.

3.2. ERBVT PROTOCOL

RBVT (Road-based vehicular traffic) algorithm is further extended in to RBVT +RPS protocol for improving the performance of our average packet delivery ratio with minimum delay, by using a predefined weight factor taken similar to the intersection mode of RPS (Reactive Pseudo-suboptimal-path Selection routing protocol) protocol related packet delivery system. In this chapter we are described our both of the algorithms one by one sequentially in upcoming sections.
Intersection mode of RPS adopts the idea that the packet is delivered along road. The road segment is dynamically selected one by one. Once a node lying in an intersection receives a packet, it will calculate a weight for each neighboring road segment. The segment with the highest weight is considered as the optimal path. Then the node delivers the packet to neighbor on this segment. The weight considers the connectivity of the segment and the distance between the segment midpoint and the destination node. The weight of road segment Ri is equal to .

$W_i = \text{alpha}\,(1 - D_i / D_c) + (1-\alpha)\, C_i$

Notations in Eq.1 are explained as follows.

D_i: distance between the midpoint of Ri and the destination node.

Dc: distance between the current intersection and the destination node.

Di/Dc: it indicates the closeness of segment Ri to the destination.

Ci: estimated connectivity of Ri by local information.

α and β: weight factors for distance and connectivity respectively

$\alpha + \beta = 1$ or $\beta = 1-\alpha$

On the basis of the above equation we calculate weight for different road segment, among all the weight highest weight is considered as next current segment.

In this way by applying intersection mode of the RPS control the transmission of data and decision of next segment in the root of accessing destination, at the end of this step Cp stack is updated with the value of I_J, I_{JNXT} and the timing involved in transmission of data from I_J, I_{JNXT} is stored in Cp. states.

4. RESULT

Our algorithms for conventional RBVT-P routing is designed for 8 BTS node intersection points having 50 vehicular nodes scattered on 11 road segments as shown in above figure 1.
Each vehicular nodes iteratively receives the RU (route update) content from the BTS as shown in figure under the heading RU content(shown in table 3), where each row in the RU content table represent the BTS intersection name I1, I2 ,I3 , I4 , I5 , I6 , I7 , I8 and second to last column represent the intersection which are connected to the BTS of the respective row , where Iv represented that there is no connection with the particular intersection On running the simulation the RBVT routing starts from the source and apply the protocol of routing for forwarding packets in a loop with the information of the next and current intersection point in the course of routing towards the destination .

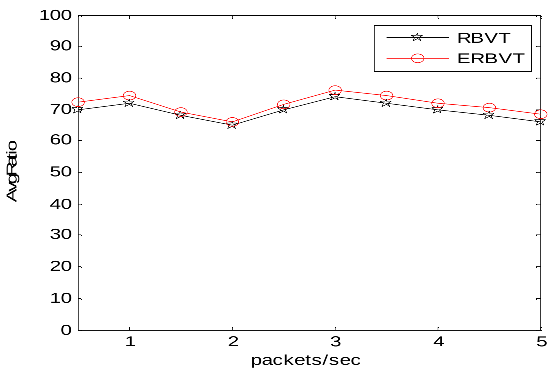

Fig. 2 Average packet delivery ratio w.r.t. packets sent per seconds .

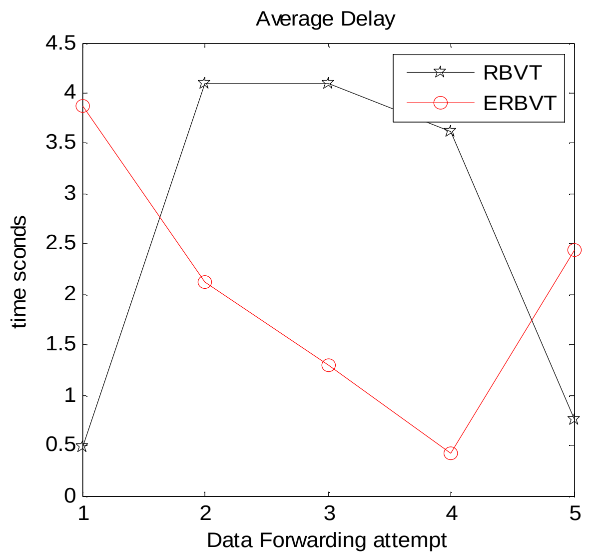

Fig.3: Average delay time (sec.) for forwarding data in each segment

In every selection of new intersection report is generated that have been shown below.
First of all for current transmission algorithms shows the table of RU content() on the command window then after it shows the status of unicast request , if the request is acknowledged then it forward the data ,otherwise message display. Waiting for unicast acknowledgement this message along with the waiting time regularly display until the current node does not receives the acknowledgement. On receiving the acknowledgement the generated Cp packet is displayed, which shows the information about data transmission range as perimeter, current and next intersection as a stack. In this way RBVT and ERBVT (RBVT-RPS) working after using RPS in RBVT.

fig.2 represent the average delivery ratio between RBVT and ERBVT, fig.3 represent the Average delay time (sec.) for forwarding data in each segment [11][12].

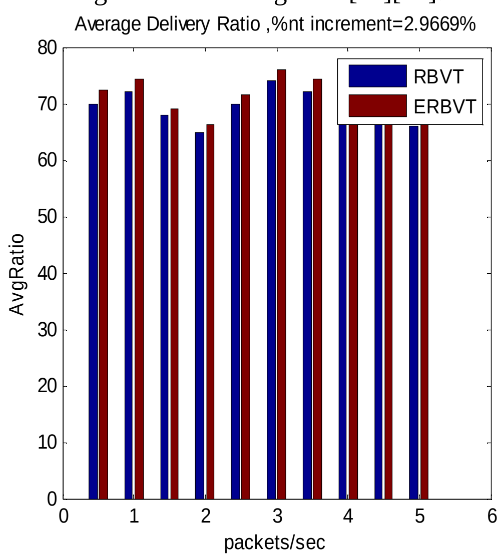

Fig.4 Average packet delivery ratio w.r.t. packets sent per seconds

Fig,4 represent the bar chart of Average packet delivery ratio w.r.t. packets sent per seconds , while fig .5 is Bar chart representation average delay time (sec.) for forwarding data in each segment .

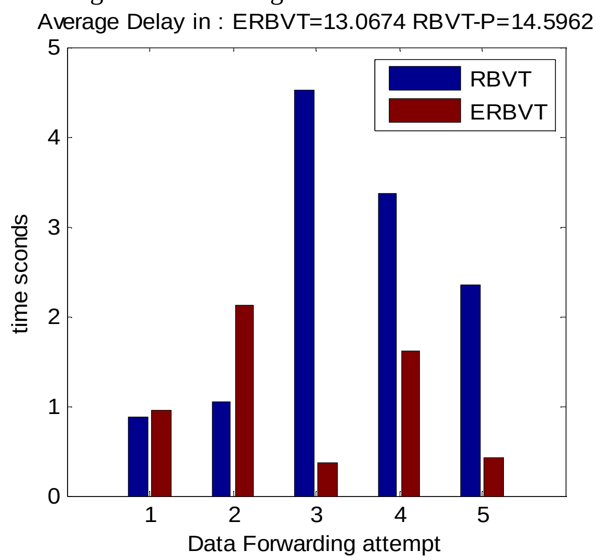

Fig.5 Bar chart representation average delay time (sec.) for forwarding data in each segment

5. CONCLUSION

This thesis work based on the area of intelligent traffic control for the inter vehicles communication called as V-V communication or VANET. We are developed an algorithms with concerning an environment in which a vehicles can communicate to its neighbouring vehicles with the control of distributed base station at different intersection point of road. The developed algorithms concentrate on the concept of direct communication by sending vehicles messages one to one to a destination vehicles via wireless communication .We have consider that this vehicle to vehicle system base algorithms in the above network with providing secure data transmission in a high mobility and changing location of the vehicle node in a predefined structured road map is generated by BTS information. The complete work is divided in to two steps-In Steps -1 we have developed an algorithm for demon strating the vehicular network performance in turns of delay and delivery ratio for the conventional RBVT –P protocol then after the conventional RBVT-P algorithms is extended by incorporating intersection mode of RPS protocol to eliminate the decision in accuracy at the intersection having more than one neighboring connected road segments with favourable condition of packet transmission ,the newly developed algorithms is called RBVT+RPS routing protocol. The performance of the both routing protocols are justified and division started average delay time consume on propagating message over each segments, overall delay and delivery ratio.
Algorithms are runs several times for different location of vehicular node and every times it has been observed that our newly developed RBVT+RPS consume lower delay time than RBVT-P routing.

In terms of average delivery ratio in respect of packet per seconds, it has been always observed that it is found greater in case of RBVT+RPS to the range of 2-3% as compared to RBVT-P.

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