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A Novelrouting Protocol for VANETS

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Abstract

An effective routing protocol to the vehicular ad-hoc networks (VANETS) should have good performance whether status of the network. And the mobile AD hoc working group on network (MANETS), VANETS have special requirements of node mobility and extremely dependent on the application, and geographic routing protocol is one of the most suitable VANETS.GPSR is the most well known positioning agreement.In this study, we analyzed the blind void detouring problem, will appear devious perimeter for GPSR routing protocol when network contains routing void area, a node priority forward strategy method to solve this problem.The NS2 simulation results show that the proposed strategy can better realize packet forwarding and enhance package transportation efficiency.

***Keywords**: vehicular ad hoc networks, location, greedy forwarding*

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1. Introduction

The Federal Communications Commission (FCC) allocates the 5.850 to 5.925 GHz frequency band for vehicle to vehicleand vehicle to Road SideUnit (RSU) communication. In2004, FCC formulates the technical specifications for DSRCwhich supports the transmission of large volume of datawithin a short rang [1]. A number of applications have beenenvisioned in VANETssuchas road safety, driving assistance, emergency public service, business, entertainment etc [2, 3]. Internet service from onboard vehicle [4], and many more. Thus, research on VANETs has gathered momentum. Compared to the other ad hoc networks, VANETs have unique characteristics due to the high nodes mobility and unreliable channel conditions, which pose lots of challenging research issues, such as data dissemination, data sharing, routing protocol, and security issues. Specially, routing protocol is one of key technology to decide the network performance. For the routing protocol, the main requirement is to achieve minimal communication time with minimum consumption of network resources. There are many existing routing protocols which have been developed for MANETs, but most of them have been not imported directly into VANETs, which differ from MANETs by its highly dynamic topology and short lived communication linksand it forwards the packet to the vehicle that geographically closest to the destination. GPSR combined the greedy routing with face routing by using face routing to get out of the local minimum where greedy fails. It works best in a free open space scenario with evenly distributed nodes. Though GPSR protocol appears to be comprehensive solution for VANETs it suffers from the following drawbacks. Firstly, greedy forwarding is often restricted because direct communications between Vehicles may not exist due to obstacles such as truck and trees, which leads to routing loop and too many hops. Secondly, if apply first the planarized graph to build the routing topology and then return greedy of face routing on it, the routing performance will degrade. Especially, in a sparse network condition where a packet reach a node that does not have any neighbors closer to the destination than itself, the performance decreases. This condition is called routing void. There are existing methods which dealt with the routing void, most of methods are perimeter forwarding-based, such as in [5]. To overcome the problems, an improved GPSR scheme is proposed.

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The rest of the content of this paper is organized as follows. Section 2 describes the proposed scheme. The simulation result with details is analyzed in section3, followed by conclusions stated in section 4.

2. Method Node-priority Mechanism

For routing void, Scholars at home and abroad have put forward different algorithm s. In [6], increasing transmission power scheme to overcome routing void is proposed. Give up packet –based scheme is employed in [7]. All these approaches are simple solution, which is not suitable for VANETs. Road sign guide-based algorithm [8] is made, where the information about routing void was achieved by predict packet before the packet forward to refrain from the routing void. The scheme results in increasing the control overhead. Regional perimeter routing [9-11] based on left and right-hand rules in is proposed.

In this section we present the principle and assumptions of our proposed scheme. We developed our scheme based on the following general assumption:

Assumption 1: Every vehicle is capable of determining its own position and mobility by data fusion and using existing technologies such GPS, map matching and accelerator meters.

Assumption 2: Vehicles are able to verify direct neighbors with direct line of sight using radio strength signal and shares a table of neighboring.

Assumption 3: Every vehicle has a unique identity.

Based on the analysis above, position-based routing the conventional strategy handled the routing void is blindness, thus the Node-priority Mechanism based opportunistic routingis proposed, in the following parts, the detail will be described.

The overview of the proposed scheme is followed: on the perimeter of void region, the neighbor node competes by those advantages to be selected as the next-hop, which is able to refrain from the blindly forwarding that resulted in excessive routing ,further, the proposed scheme makes the overhead decreased. Applying the broadcast-forwarding theory based on opportunistic routing, blindly detour void region is prevented happening.

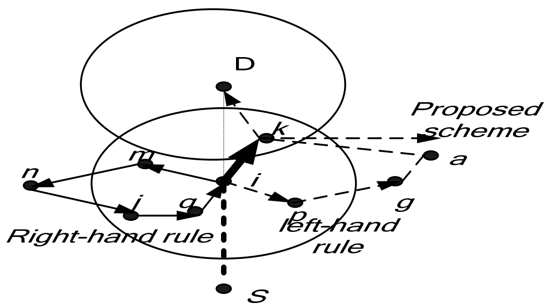

Figure 1. Proposed Scheme

As depicted in Figure 1, node *S* need to search the next-hop node and node *i* is selected as to forward the packet by the greedy forwarding model, however, if node *i* also apply the greedy forwarding model, it can't get a neighbor node to forward the packet due to void region. In the neighbor table of node *i*, node *i* is closer to destination than other nodes.

Although node *k* is more suitable to be selected as the next-hop, if applying the conventional perimeter traversal, node *k* is not considered. The intermediate node *i* has two schemes to search the next-hop, firstly, the routing path is *m-n-j-q-i*, which is based on the right-hand rule. It is obviously that packet is abandoned due to the cycle; secondly, the routing path is *p-g-a-k*, which is based on the left-hand rule, when the packet is transferred to the node *k*, routing strategy is transformed to greedy forwarding model, Compared to the scheme that node *k* is selected as the forwarding node, the number of hoping node is more 4, which not only increase the routing path, but also occupy lots of network resource, worse, it lead to network congestion and many packets are loss. As shown in Figure 1, when a packet is forwarding, the information of all neighbors node should have been taken into account, only analysis by synthesis, the global optimum forwarding node can be selected.

In Figure 1, at first, using the greedy forwarding model to transfer the packet, assume that the intermediate node *i* get the packet, because of the routing void, the node *i* is not capable of searching a node that is closer to destination than itself. In this situation, node *i* broadcast the beacon which includes the address of the destination of the packet, the beacon was credited as ADP (address-destination-packet), when all nodes that obtain the ADP, they calculate the priority-parameters, respectively. The higher the priority, the more possibility that the node is considered as the next-hop. The priority can directly the packet forwarding efficiency of the node which will be utilized to the next-hop. The priority of node is followed as:

$$p(D,x,S) = [(1-a)\frac{D(x)}{D(S)} + a * \frac{N_c(x)}{N(S)}] * per(x) \qquad (2)$$

Where, $p(D,x,S)$ is the priority of forwarding node *x. S, D* is the data source node and destination node, respectively. $N(x)$ is the number of the second-lien neighbors , $N_c(x)$ is the number of neighbors that is closer to destination than *x*, the number is greater ,the more chances for detouring the void region . α is the coordinated-parameter, according to observed value from the experiments, and α =0.7. $pex(x)$ is the rate of the package loss in link between *x* and *S.*

In Equation (2), objective factors such as forwarding distance, packet drop rate and the forwarding success rate, will be taken into consideration. In accordance with the above analysis, the value of $p(D,x,S)$ is greater, the more opportunities of a node that be selected as next-hop.

When a node (e.g. node *k*) receives this ADP, it checks if the packet was received before. If there is a hit, that means it received this packet before. It will simply drop the ADP since it cannot make any further propagation progress than that of node *x* that broadcasted ADP. If this is a brand new ADP, node *k* saves this packet into buffer and set a timer with the runtime of:

$$t(k) = \lfloor (1 - p(D,k,S))C_{slots} \rfloor + T_{random} \qquad (3)$$

Where $p(D,k,S)$ is the node *k* priority parameter, C_{slots} is the maximal forwarding delay, C_{slots} =30. T_{random} is real randomly chosen from (0.1, 0.5), which is applied to avoid conflict from the neighbors. As the timer's runtime of every node is proportional to it $p(D,k,S)$ the one closest to the destination will first time out.

As shown in Figure 3, node *k* will first time out and send back the ACK message along with node *k*. After receiving the first ACK sent from *k*, node *i* immediately send a data packet along with previously received node *k*. If the data packet is sent before the second ACK is received, all its neighboring nodes will be suppressed by the data message. The procedure of node -priority Mechanism is followed as:

(1) node *k* receives a ADP packet from node *i*.
(2) node *k* obtains the address of the destination
 a. node *k* obtains the factors in Equation (2)
 b. node *k* calculates the priority parameter
(3) node *k* set a timer with runtime that the value is computed by Equation (3)
(4) when node *k* time out, send back the ACK
(5) if the ACK from the node *k* is the first node *i* had ever received, node *k* will be selected as the next-hop.

3. Performance Evaluations

In this section, we evaluate the performance of the proposed scheme in NS-2. We mainly consider the three parameters for evaluating the performance for our proposal, End to End delay, the packet delivery success rate and routing path length, respectively. Each scenario is repeated 20 times to achieve results with a high level of confidence. Details of simulation parameters are listed in Table 1.

To evaluate the network performance of the proposed scheme, we evaluate how different nodes moving pause time affect the network performance, in terms of End to End delay, the packet delivery success rate and routing path length.

Table 1. DTC-CSF System

Simulation area	**1000*1000m**
Nodes' moving pause time	**0,30,60,120 s**
Node mobility models	**random waypoint**
Number of nodes	**50**
Speed of nodes	**0m/s-20m/s**
Transmission range	**250m**
Data packet size	**64 Byte**
Simulation time	**1000 s**
Parameter	value

As shown in Figure 2, the longer the nodes moving pause time, End to End delay can be fall. When the nodes' moving pause time is longer, it means that the nodes move slower, the topology of network is not changed quickly.

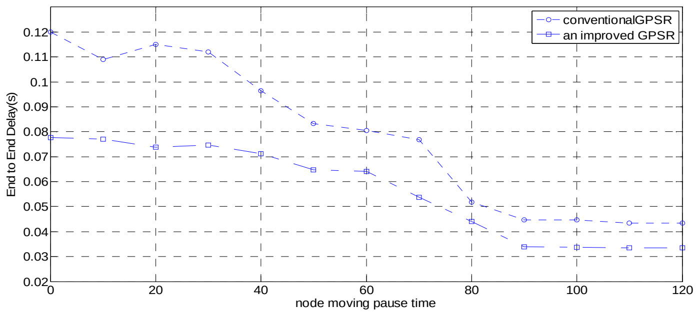

Figure 2. End to End Delay vs Nodes Moving Pause Time

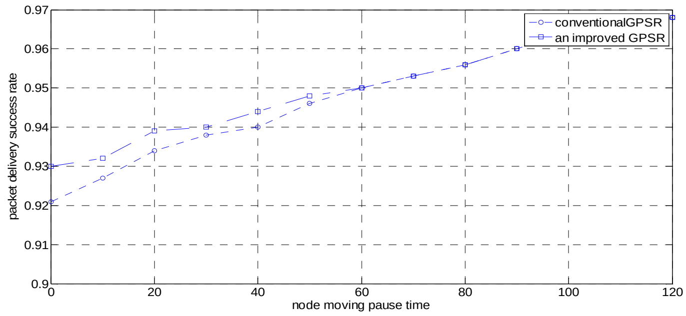

Figure 3. Packet Delivery Success Rate vs Node Moving Pause Time

As depicted in Figure 3, when nodes moving pause time is 60 and 120*s*, the packet delivery success rate of conventional GPSR and our proposed scheme is very similar, but our proposed scheme demonstrates better performance while nodes moving pause time is short (e.g. 30*s*). The reason for this is that an improved greedy forwarding shortened the routing forwarding path and the time of the packet delivery is short. When nodes move quickly, time of the packet delivery shorter, topology of network changed smaller, which lead to raise the rate of the packet delivery success.

It can be seen from Figure 4 that the average number of packet hopping has shrunk with nodes moving pause time increased in conventional GPSR and our proposed scheme due to enhance the stabilization of network. Compared to conventional GPSR, average number of packet hopping our proposal scheme reduced, whether the move quickly or slowly. It is for the reasons that node-priority mechanism effectively solve the routing detour in the conventional GPSR and shorten the routing path length.

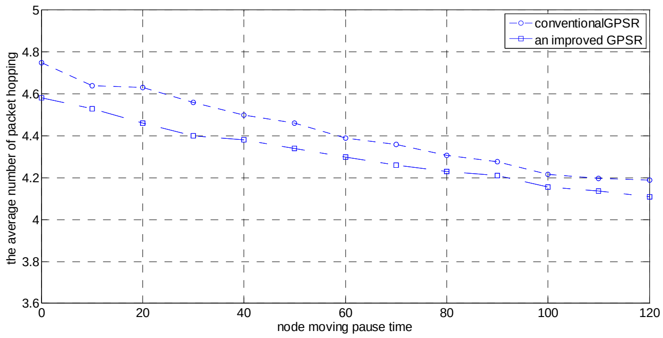

Figure 4. Packet Delivery Success Rate vs Node Moving Pause Time

4. Conclusion

In this paper, we propose an improved greedy perimeter stateless routing scheme based node-priority mechanism to deal with void routing availably. Compared with conventional GPSR, an improved GPSR demonstrates better performance in terms of packet delivery success ratio, End to End delay and routing path length.

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