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A Novel Method for Determining Link Correlation and Candidate Key in VANETs

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Abstract: A Collection of optimal relaying node in an intra-street and excellent of the eventually street at the intersection are the dominant challenging issues merit to its valuable mobility and uneven selection of vehicles in social Vehicular Adhoc NETworks (VANETs). In this paper , the probability of link availability can be estimated by a standardize model which considers the stable and unstable vehicle states. In an existing work, the periodic route discovery message broadcasting increases the delay in path establishment. A new concept called the link correlation which represents the influence of different link combinations in network topology. The link correlation concept is applied to transmit a packet with less network resource amount and higher profitable put. Based on link correlation, an opportunistic routing metric is designed as the assignment guidance of a relaying node in intra-streets and it is called as Expected Transmission Cost around a multi-hop Path (ETCoP). This opportunistic routing metric can further provide use for the next street selection at an intersection. Ultimately, a street-centric opportunistic routing protocol is considered based on ETCoP (SRPE) for VANETs. Forwarding candidate selection technique based on velocity vector is contributed to recover the performance.

Keywords: ETCoP , SRPE , VANETs.

Introduction

VANETs in complex urban environments are one of special-type networks, which consist of vehicles equipped with communication devices.

The urban VANETs have the following characteristics: (1) Frequent changes in network topology due to high mobility, (2) The topology of networks can be regarded as a subset of city map and the movement of vehicles are restricted along the streets and by the traffic conditions. (3) They can easily obtain the information about their geographical positions, moving direction and velocities, etc., using Global Position System (GPS) and a street-level digital map that are already equipped in vehicles. (4) The distribution of vehicles along the streets is uneven and it depends on the conditions of streets, such as one-/two way streets, speed limit and traffic conditions. Designing an efficient routing protocol is one of key issues in VANETs. However, due to high mobility, uneven distribution of vehicles and restricted movement in urban environments, it is very difficult to maintain the global topology of VANETs for every vehicle. Conventional node-centric routing protocols was proven to be worse than the street-centric routing protocols in which the streets are selected one by one instead of finding the entire routing path in advance with a divide-and-conquer approach. How to select an optimal relaying node in an intra-street and how to determine a street selection at the intersection are two challenging issues in designing an efficient routing protocol in complex urban environments[6].When selecting a relaying vehicle in an intra-street or the next street at an intersection, the selected metric (or information) and strategy may affect the performance of a routing protocol.

And the main objectives of this paper is to discuss the following strategy ;

- To transmit a packet with less usage of network resources and higher good put.
- To improve the packet delivery ratio.
- To reduce the end-to-end delay and larger network capacity.

Existing Work

In existing work, a road-based (the same as street-based) vehicular traffic (RBVT) routing protocol is implemented as a reactive protocol RBVT-R and also as a proactive protocol RBVT-P[10]. In the RBVT-R, a source broadcasts a route discovery (RD) message to establish a global routing path. In the RBVT-P, each node uses the periodic connectivity packets (CPs) to maintain the information of the entire topology in a distributed manner.The disadvantages occurs in reduces the packet delivery ratio and increases its delay.

Proposed Work

Designing an efficient routing protocol is one of key issues in VANETs. However, due to high mobility, uneven distribution of vehicles and restricted movement in urban environments, it is very difficult to maintain the global topology of VANETs for every vehicle in street-centric routing protocols, in which the streets are selected one by one instead of finding the entire routing path in advance with a divide-and-conquer approach.

The main contributions of this proposed work are as follows: 1) A novel concept is proposed called the link correlation and a new routing metric (ETCoP) is designed with a gradient property based on the link correlation. ETCoP aims at transmitting a packet with less usage of network resources and higher goodput with an opportunistic routing scheme. The signal fading, mobility of vehicles with stable or unstable vehicle states to characterize the link model.

The proposed routing metric, packets can be effectively forwarded in intra-streets. 2) A street-centric opportunistic routing protocol is proposed based on ETCoP for VANETs. Utilizing proposed ETCoP routing metric, the routing performance of each adjacent street at intersections is improved. Therefore, dynamically a routing decision is made at the intersections one by one without maintaining of global topology information.

The advantages are to increases the packet delivery ratio and reduces its the end-to-end delay.

Related Works

1. According to the authors , Honghai Wu and Huadong Ma. characterize the concept of **Opportunistic Routing For Live Video Streaming In Vehicular Ad Hoc Networks.**

2. According to the authors , Jing Zhao and Guohong Cao. characterize the concept of **VADD: Vehicle- Assisted Data Delivery in Vehicular Ad Hoc Networks .**

3. According to the authors ,Josiane Nzouonta, Neeraj Rajgure, Guiling (Grace) Wang, and Cristian Borcea. characterize the concept ofthe **VANET Routing on City Roads Using Real-Time Vehicular Traffic information**. Multihop data delivery through vehicular adhoc networks is complicated by the fact that vehicular networks are highly mobile and frequently disconnected[15].

4. According to the authors , Josiane Nzouonta, Neeraj Rajgure, Guiling (Grace) Wang, and Cristian Borcea. characterize the concept of **VANET Routing on City Roads Using Real-Time Vehicular Traffic information.**

5. According to the authors, Sanjit Biswas and Robert Morris , concept of **ExOR: Opportunistic Multi-Hop Routing For Wireless Networks** characterize the concept of an integrated routing and MAC protocol that increases the throughput of large unicast transfers in multi-hop wireless networks[12].

6. According to the authors, Christian Lochert, Hannes Hartenstein, Jing Tian, Holger fiirler, Dagmar Hermann, and Martin Mauve. characterize the concept of A **Routing Strategy For Vehicular Ad Hoc Networks In City Environments.**

Routing of data in a vehicular ad hoc network is a challenging task due to the high dynamics of such a network. Recent it was shown for the case of highway traffic that position-based muting approaches can very well deal with the high mobility of network nodes.

Implementation

The Expected transmission cost over a Multi-hop path(ETCOP) in proposed work, we examine to transmit a packet with less usage of network resources and to improve the packet delivery ratio to reduce the end-to-end delay and larger network capacity.

1. Determination Of Link Correlation

Link correlation represents the influence of different link combinations in network topology to transmit a packet with less network resource consumption and higher goodput. The ETX of a path is the sum of the ETX of all the links along the path. The expected transmission time (ETT) of a packet over a link accounts for the loss rate and bandwidth of the link, and it also considers the interference of the links which use the same wireless channel. Each vehicle maintains the successful transmission rate which is calculated and updated upon receiving a beacon packet from its neighbor. The ETX of an individual link is the reciprocal of the successful transmission rate. The total expected number of transmissions for one packet in each path is different. The link correlation is introduced in the opportunistic routing scheme with simplified calculation of chain-links. In this, if two adjacent paths having different link sequences, same amount of packets are passed through the Paths and have the same ETX, a different amount of network resources are consumed. When a packet is not successfully received by the end node, the expected number of transmissions of an k-hop path p is estimated under the failed receptions of the end node as $F(k)_p$. The detailed calculation of a chain-link for successful transmission is shown below.

$$F(k)_p = 1 - P_k + 2P_k(1-P_{k-1}) + \dots + kP_kP_{k-1}\dots P_2(1-p_1).$$
$$= 1 - P_k + \sum_{n=2}^{k} n(1-P_{k-n+1}) \prod_{i=k-n+2}^{k} P_i$$

Where, P_i denotes the link quality of the i^{th} link of path p from the destination to the source. To reflect the real transmission cost of a packet transmitted from the source to the destination, define the expected transmission cost ETCoP $(k)_p$, which represents the total transmission cost on each link along the path p, when a packet is successfully received at the destination vehicle.

$$ETCoP\,(k)_p = \frac{F(k)_p + k \prod_{i=1}^{k} P_i}{K \prod_{i=1} P_i}$$

Where $\prod P^{k} ii = 1$

i=1P_i is the aggregate of the link qualities of all the links from itself to the destination. Therefore, the end-to-end packet delivery ratio and the whole transmission cost along the path is considered to design a routing metric based on the link correlation.

2. Determination Of A Candidate Set

The vehicles in the candidate set should satisfy the two rules.

(i) The vehicles in the candidate set should have greater geographic process than the sender, which ensures the direction of propagation.

(ii) The vehicles in the candidate set should have smaller ETCoP values than the sender, which ensures the selection of relaying vehicles to be appropriate.

When a source vehicle wants to send a packet to destination vehicle, it calculates the ETCoP and assigns the priorities of neighbor vehicles.

In the opportunistic relaying scheme, a sender broadcasts a packet and then a vehicle with the highest priority is

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selected from the vehicles, which has successfully received the packet in the candidate set in a distributed manner.

RESULT AND DISCUSSIONS

The performance of ETCoP (Expected Transmission Cost Over a multi-hop Path) is analyzed using Network Simulaor2. The experimental model is with 100 nodes distributed randomly.

Network Architecture

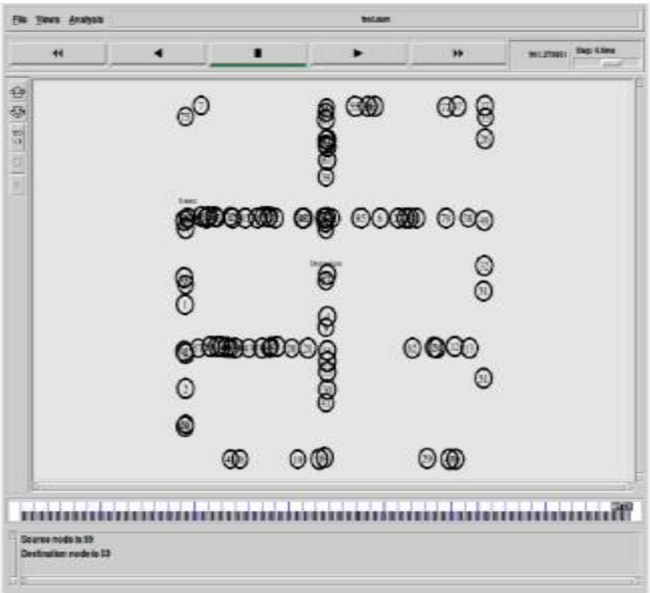

Fig. 1 Network Architecture

The architecture of network with number of nodes, the source node is 99 and destination node is 53 the packets are transmitted through the sources to destination. square Ssurface of 600×600m^2 shown in the fig.1.

Link Correlation

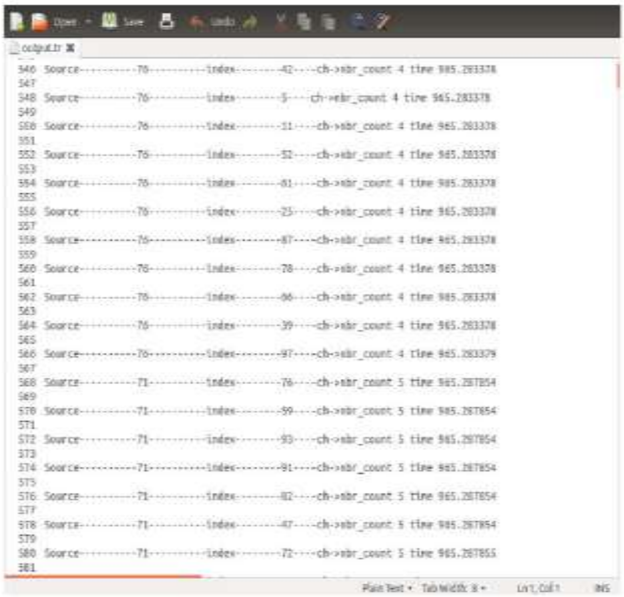

Fig. 2 Link Correlation

Each node maintains the neighbour count and attaches the neighbour count in hello message which is shown in the fig.2.

Expected Transmission Count

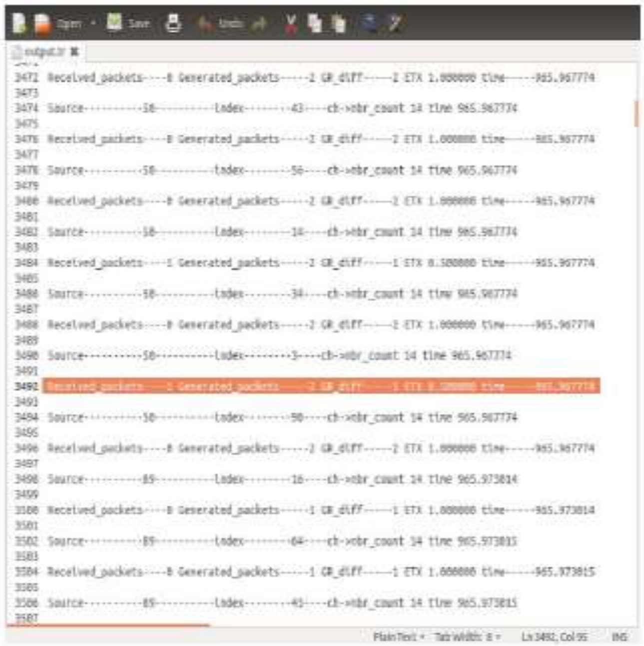

Fig.3 Expected Transmission Count

When the hello message is received by neighbour nodes, they calculate the Expected Transmission Count (ETX) based on generated packet counts and received packet counts.

GR_difference = Generated packets – Received Packets
ETX = Generated packets - Received Packets / Generated Packets.

Those count is shown in the fig.3.

ETCOP(Expected Transmission Cost of multi-hop Path)

Fig. 4 ETCOP

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The data transmission each router calculate the Fc (Chain link) and ETCoP (Expected Transmission Cost of multi-hop Path) for both paths, which is shown in fig.4.

Data transmission

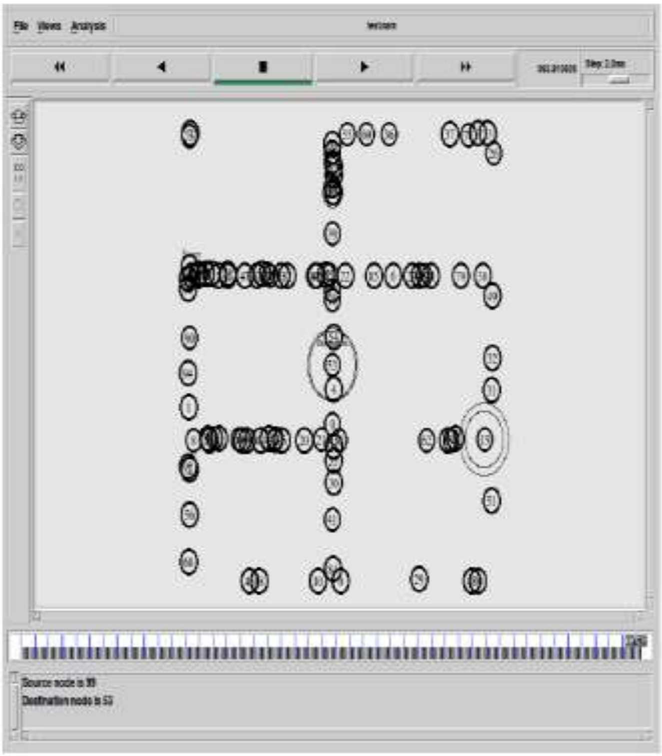

Fig. 5 Data Transmission

The packets are transmitted from source to destination using ETCOP algorithm to show the Data transmission between them, which is shown in fig.5.

COMPARATIVE GRAPH

Packet Delivery Ratio

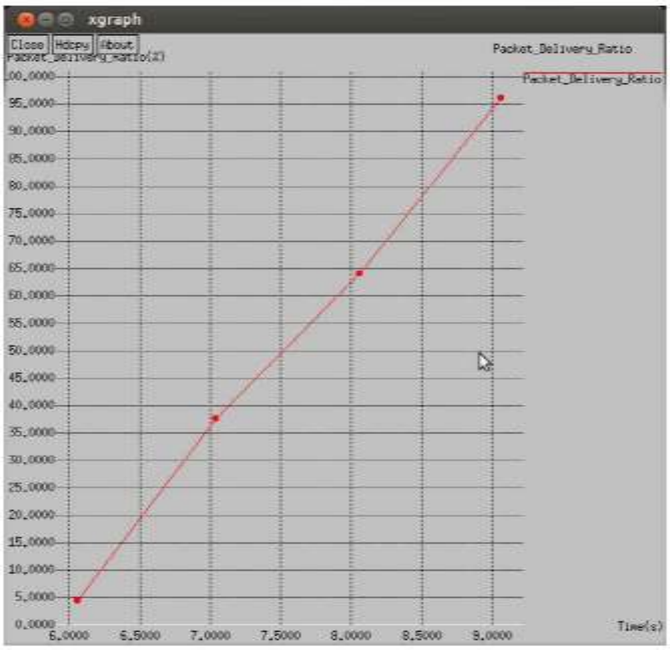

Fig. 6 Packet Delivery Ratio

Here the X-axis is represents time interval and Y-axis represents the Packet Delivery Ratio (%). Packet Delivery Ratio of enhanced method is higher when compared with proposed method. And the comparative graph on Packet Delivery Ratio of proposed and enhancement Method are shown in the Fig. 6 .

Delay

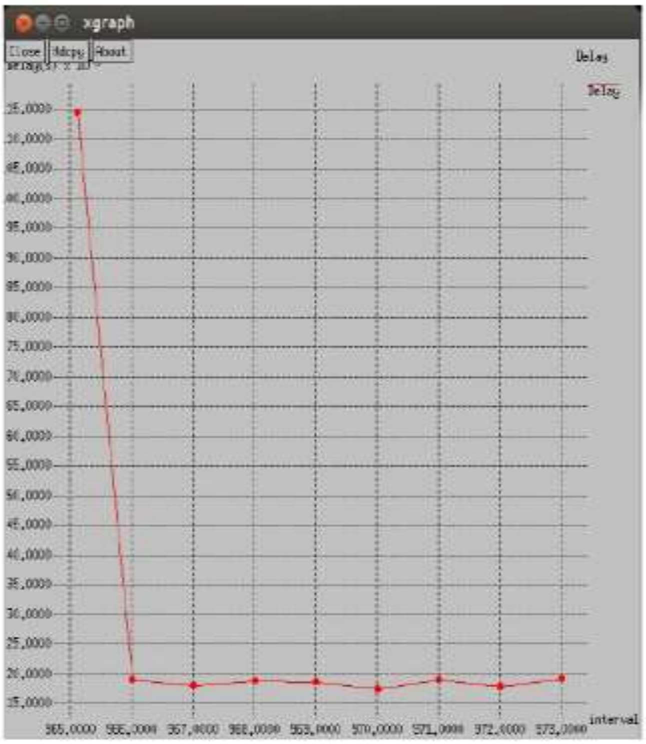

Fig. 7 Comparative Graph and Delay

Here the X- represents the time interval and Y-axis represents the Delay. As the number of the time interval increases, the Delay also increased and enhancement achieves better Delay when compared to proposed method. Here the comparative graph on Delay for propose and enhanced method are shown in Fig. 7 .

CONCLUSION

This paper proposes the expected transmission cost of multi-hop path (ETCoP) routing metric to advance the maximum forwarding reliability and minimal transmission cost in intra-streets based on the link correlation and velocity vector. A new link model has been designed to fix the complicated urban environments which considers the signal fading and vehicle movement characteristics. Finally, proposes the street-centric opportunistic routing protocol based on ETCoP in which packets are dynamically forwarded at the intersections based on the neighboring street information. In street-centric opportunistic routing, velocity vector further considered to advance reliable communication, shorter end-to-end delay and high packet delivery ratio compared with other acknowledged protocols. In this field, Communication between vehicles is to conform the path.

And the future work to the traffic is to be reduced to send the packets within a supposing time.

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