iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 2 **Issue:** IV **Month of publication:** April 2014

DOI:

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

Link Lifetime Prediction in Position-Based VANET Routing Protocol

Annu Kurien, A.Diana

Department of Computer Science and Engineering,
Karunya University

***Abstract*-Vehicular ad hoc network enables the vehicles to wirelessly network with other vehicles nearby without the aid of a permanent infrastructure. One of the main design constraints of vehicular ad hoc networks is that they have a rapidly changing environment. There should be a reliable routing protocol that has the ability to determine a reliable path for the communication. The position based routing protocol knows about the position of each and every vehicles in the network. RIVER, a reliable inter-vehicular routing protocol performs real-time, active traffic monitoring and uses these data and other data gathered through passive mechanisms to assign a reliability rating to select the most reliable route. This paper focuses on the enhancement of a reliable inter-vehicular routing protocol for vehicular ad hoc network by using link lifetime prediction.**

***Keywords* – VANET, RIVER, reliable, link, lifetime prediction**

1. INTRODUCTION

Vehicular ad hoc network [1] is an emerging technology that would allow vehicles on roads to form an organized network. The nodes that are participating in VANET are mobile. Within this rapidly changing environment, messages should be passed from node to node in order to reach the desired destination. Messages between source node and destination node are sent through intermediate nodes. The IEEE 802.11p [2] is the standard for wireless access in vehicular environment. The vehicles which are participating in the network are equipped with on board sensors through which the interaction between the nodes takes place. An efficient routing protocol should be there to route packets between the varying VANET environments.

Temporary gaps in network coverage are common on most of the streets at recurrent intervals. A network gap occurs when the distance between a node and its nearest neighbor node is greater than the transmission ranges of both of them. Network gaps may even occur when traffic signals stop vehicular traffic and also when the road is occupied with vehicles in which most of the vehicles are not equipped with wireless transceivers and computerized modules.

Sometimes the forwarding of messages is not possible due to the factors like road characteristics and network gaps. A VANET routing protocol must have a method to determine which street edges are most likely to result in delivery of a packet to the next node.

RIVER [3] protocol uses an undirected graph which represents the street layout where the vertices are the points like streets curve and the graph edges are the street segments. The protocol is based on estimating the edge reliability to determine the reliable path. In order to improve reliability in RIVER protocol, link lifetime prediction could be used.

2. LITERATURE REVIEW

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

A routing protocol helps in exchanging information between nodes in the network. It provides the way for establishing a route, forwarding decisions, and actions for maintaining routes. Topology based routing, cluster based routing, geocast routing, broadcast routing and position based routing protocols are the different types of routing protocols in VANET.

To discover the route and for forwarding packets, linked information is used in topology based routing protocols [4]. In cluster based routing protocols [5], a node would be designated as the cluster head and it would broadcast the packets to the cluster. In broadcast based routing protocols [6], flooding mechanism is used in which each node rebroadcast the message to other nodes. In geocast based routing protocols [7], each node delivers the packet to all other nodes that are within the specified geographical region. The position based routing protocols [8] use geographic position information in order to select the next node so that the position of each and every vehicle in the network could be known. The following section describes about the different position based routing protocols in VANET.

Connectivity aware routing (CAR) protocol [9] was proposed by Valery Naumov and Thomas R. Gross. The CAR protocol is based on PGB [10] and AGF [11]. The protocol involves the course of actions like destination location and path discovery, data packet forwarding along the discovered path, path maintenance with the help of guards, error recovery. The protocol provides a scalable low overhead routing algorithm and idealized location services are not required to locate destination. The defect of the protocol is that it could not adjust with different sub-path when traffic environment changes.

An adaptive connectivity aware routing protocol (ACAR) [12] was proposed by Q.Yang and *etal*. The protocol chooses an optimal route based on the statistical and real-time density data. The chosen optimal route might be of the best transmission quality. At first, the protocol computes the data based on the statistical density data by using a preloaded map of the street. Then this information would be added to the packet headers and transmits the packet along the chosen route. It provides higher data delivery ratio and reduced networking overhead. It requires digital map which consists of historical data.

Vehicle assisted data delivery protocol [13] was proposed by Jing Zhao and Guohong Cao. This protocol could forward the packets to the best route with reduced data delivery delay. It employs carry and forward mechanism. For forwarding packets to the next node, alternatives like location first probe, direction first probe and multi-path direction first probe could be used. It is suitable for multi-hop data delivery and could be used to deal with disconnectivity in road segments. The carry and forward approach could cause very large delay.

James Bernsen and D. Manivannan proposed a reliable inter-vehicular routing protocol for vehicular ad hoc networks (RIVER). The RIVER protocol selects routes that are reliable though its traffic monitoring components. There should be sufficient number of nodes in the network for forwarding messages. Sometimes, the forwarding of messages is not possible due to the factors like road characteristics and network gaps. The goal of the RIVER protocol is to solve the routing problems in VANET by transmitting a message along a reliable route and to recalculate the routes dynamically during message transmission. This could be done by performing real-time traffic monitoring using both active and passive mechanisms.

In the network, each node maintains a copy of the nearby street layout in its street graph. It is an undirected graph in which vertices of the graph are the points at which street curve or intersect and the graph edges are the street segments between those vertices. A node can discover neighboring nodes and their locations via probe messages. The traffic monitoring could be done in real-time by actively sending probe messages beside streets and by passively monitoring messages that are transmitted between neighboring intersections. Dijkstra’s least weight path algorithm [14] is used to calculate the reliable routing path. The smaller weight indicates greater reliability and a larger weight indicates unreliability. The edge’s reliability

Vol. 2 Issue IV, April 2014

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

rating can be defined as shared when a node writes the edge's reliability rating in to the packet's known edge list for sharing the information. The edge's reliability rating is said to be declared when a node reads the rating from a known edge list in a packet that it has received. The protocol is street-aware in the sense that it attempts to direct messages all the way through vehicles along streets.

3. LINK LIFETIME PREDICTION

In VANET, the network topology is changing continuously due to the mobility of nodes in the network. Hence the wireless communication links are unstable. It is essential to develop a VANET routing protocol that is reliable to fit the traffic information on the fly.

Namboodiri and *etal* has proposed prediction based routing for vehicular ad-hoc network [15]. The network topology changes consistently because of high mobility. This instability could be avoided by knowing about the stability of various potential links along the route. The mobility based routing is said to be reliable when traffic is stable and not jammed. When the traffic is jammed or congested, the mobility based routing does not work well. Since vehicles need to know about the mobility status of neighboring vehicles, vehicles have to send messages periodically to each other. The flow of work in RIVER protocol when it is incorporated with link lifetime prediction is shown in the architecture in figure 1.

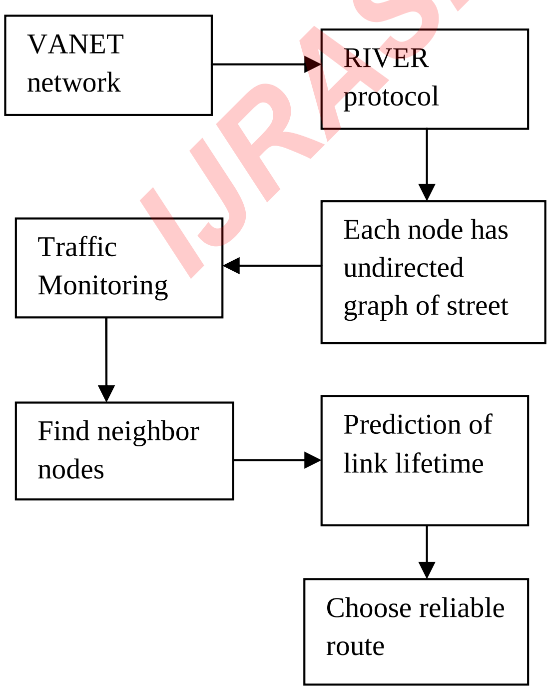


Fig 1: The Architecture of RIVER protocol

While incorporating the link lifetime prediction in the position based VANET reliable routing protocol, the edge could be considered as a link in the street graph. Lifetime of this link is computed based on the distance between the neighboring nodes that are travelling along the respective edge. Each node participating in the network would be equipped with GPS. Lifetime of the link represents how far that edge could be used for routing a message. The distance between the current node and its preceding node would be computed. The current node will update this distance information and forwards it to the next neighboring node that was found via probe messages. When the next node's distance with its preceding node is computed, then the value obtained would be added to the distance value which was obtained from the preceding node. This node would update new distance information in the packet and forwards it to the next neighboring node. Finally, the different link information of different possible paths would be reaching the destination node.

The reliability in RIVER protocol could be improved by incorporating the link lifetime prediction instead of edge reliability calculation. Edge reliability value can be calculated based on the timestamp of the probe messages being sent to the nodes in the network. By predicting the link lifetime of the route, the reliability in route selection could be improved.

The methodology includes traffic monitoring and link lifetime. They are described in the following sections.

3.1. TRAFFIC MONITORING

The protocol performs real-time traffic monitoring using an active mechanism. The primary mechanism for active monitoring is probe message. Probe message is a packet that is periodically sent by each node in the network. A node which is located near a street vertex sends a probe message and it is forwarded to the next nodes along the street edges that are incident to the street vertex.

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

The probe message is dropped if there is any network gap along the street edge. If the probe message is delivered to the destination vertex then nodes near that vertex become aware that the vertex is traversable at that moment and a return probe message is sent back to its original sender. The probe messages include each forwarding nodes geographic position and address. They also include the address and geographic position of their original sender, and the position of their destination vertex. Hence the probe message contains known edge list which identifies edges by their end point geolocations and communicates reliability information about each edge along the path.

3.2. LINK LIFETIME

The vital part of the protocol is its ability to predict approximately the lifetime of a particular street edge. This helps to determine the most suitable path from a sender node to a receiver node.

The link in the street graph would be the edge. Lifetime of the link is determined based on the distance between the neighboring nodes along the particular edge. After identifying the neighboring nodes, distance between each of them would be computed based on each nodes position in every two seconds. The communication link lifetime information would be updated in the routing packet. The route request send by the sender node reaches the destination node along the different available paths. The destination node sends route reply message along the most reliable path which is having favorable link lifetime. If a next hop node is not found, then probe messages are sent and the neighboring nodes are identified. And again the link lifetime would be computed.

The neighboring nodes are found within 100m. If the obtained link lifetime is less than 30m then it is the most favorable link. If the obtained link lifetime lies between 30m and 60m then it is the favorable link. If the obtained link lifetime lies between 60m and 100m then it is the least favorable link. If the obtained link lifetime is greater than 100m then it is not favorable.

After computing the link lifetime of each of the communication link, the reliable routing path should be chosen. When the links are having lower values, then its lifetime will be higher. When the links are having higher values, its lifetime will be smaller. The most favorable path will be of the links which are having lower values. Hence the destination node selects the most reliable path whose lifetime is higher.

4. PERFORMANCE EVALUATION

To evaluate the reliability in RIVER protocol by incorporating with link lifetime prediction, the protocol was simulated using *ns-2* simulator using the default 802.11 bandwidth and it included WirelessPhy interface, the two-ray ground propagation model, omnidirectional antenna and wireless channel configurations. For the simulation, a street grid was created which is 550 × 550. And about twenty five moving vehicles were considered in the street layout. The performance metrics include the parameters such as data throughput, route transit time.

4.1. DATA THROUGHPUT

Data throughput represents the mean percentage of the transmitted packets that were delivered successfully. The graphical representation of data throughput with edge reliability and link lifetime is shown in fig.2. When the protocol is incorporated with link lifetime prediction, it results in higher data throughput than the other.

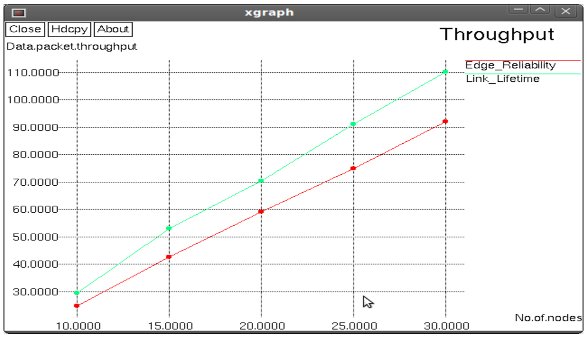


Fig.2. Data Throughput

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

4.2. ROUTE TRANSIT TIME

Route transit time represents the time required to deliver a routing packet from its original sender to its final destination. The fig.3 represents the graphical representation of route transit time with edge reliability and link lifetime prediction. It shows that when the protocol is incorporated with link lifetime prediction, the route transit time decreases compared to the one with edge reliability.

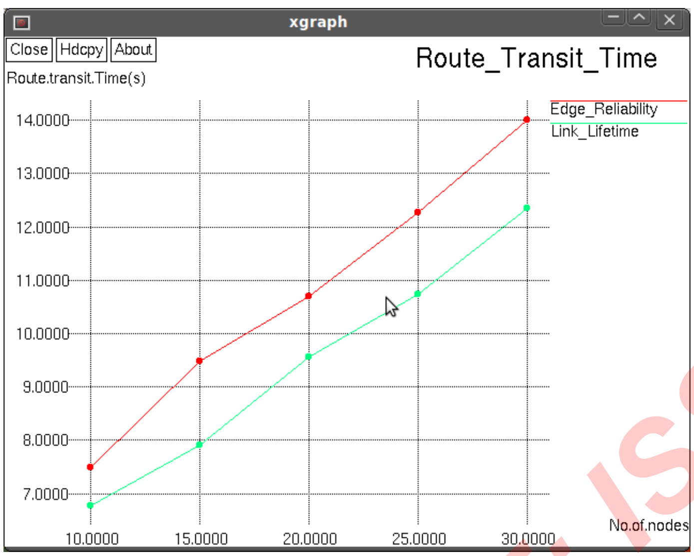


Fig.3. Route Transit Time

5. CONCLUSION

The method to improve reliability in position based VANET reliable routing protocol, RIVER, was discussed. The analysis shows that reliability in RIVER protocol could be improved by incorporating it with link lifetime prediction. It provides higher data packet throughput and reduced transmission time. Further researches have to be conducted in the area of network densities.

REFERENCES

[1] Saif Al-Sultan, Moath M. Al-Doori, Ali H. Al-Bayatti, Hussein Zedan, "A comprehensive survey on vehicular ad hoc network", *Journal of Network and Computer Applications*, vol. 37, 2014, pp. 380-392.

[2] Veronica Shivaldova, Georg Maier, Dieter Smely, Nicolai Czink, Arrate Alonso, Andreas Winkelbauer,Alexander Paier, Christoph F. Mecklenbrauker, "Performance Evaluation of IEEE802.11p infrastructure to vehicle tunnel measurements", *in Proceedings of IWCMC*, 2011, pp. 1-5

[3] J.Bernsen and D.Manivannan, "RIVER: A reliable inter-vehicular routing protocol for vehicular ad hoc networks", *Computer Networks*, 2012, pp.3795-3807.

[4] Mehran Abolhasan, Tadeusz Wysocki, Eryk Dutkiewicz, " A review of routing protocols for mobile ad hoc networks", *AdHoc Networks*, vol.2(1), 2004, pp. 1-22.

[5] Sharnjeet Kaur, Dr.Gurpreet Singh Josan, "Performance Evaluation of Topology Based Routing Protocols In Vanet", *International Journal of Engineering Research and Application*, vol.2(5), 2012, pp. 1646-1655.

[6] Kapil Baghchandani, Yatendra Mohan Sharma, "Exploration of Vanet Mobility models with new Cluster Based Routing Protocol", *International Journal of Soft Computing and Engineering*, vol.2(6), 2013, pp. 224-227.

[7] Uma Nagaraj, Poonam Dhamal, "Broadcasting routing Protocols in Vanet", *Network and Complex system*, vol.1(2), 2011, pp. 13-19.

[8] Salim Allal, Saadi Boudjit, "Geocast Routing Protocol for Vanet:Survey and Geometry Driven Scheme Proposal", *Journal of Internet Services and Information Security*, vol.3, 2013, pp. 20-36.

[9] Vivek Pathak, Danfeng Yao, Liviu Iftode, " Securing Location Aware Services Over Vanet Using Geographical Secure Path Routing", *Vehicular Electronics and Safety*, 2008, pp. 1-8.

[10] Valery Naumov, Thomas R.Gross, "Connectivity Aware Routing In Vehicular ad hoc network", *in Proceedings of INFOCOM*, 2007, pp.1-9.

ISSN: 2321-9653

INTERNATIONAL JOURNAL FOR RESEARCH IN APPLIED SCIENCE AND ENGINEERING TECHNOLOGY (IJRASET)

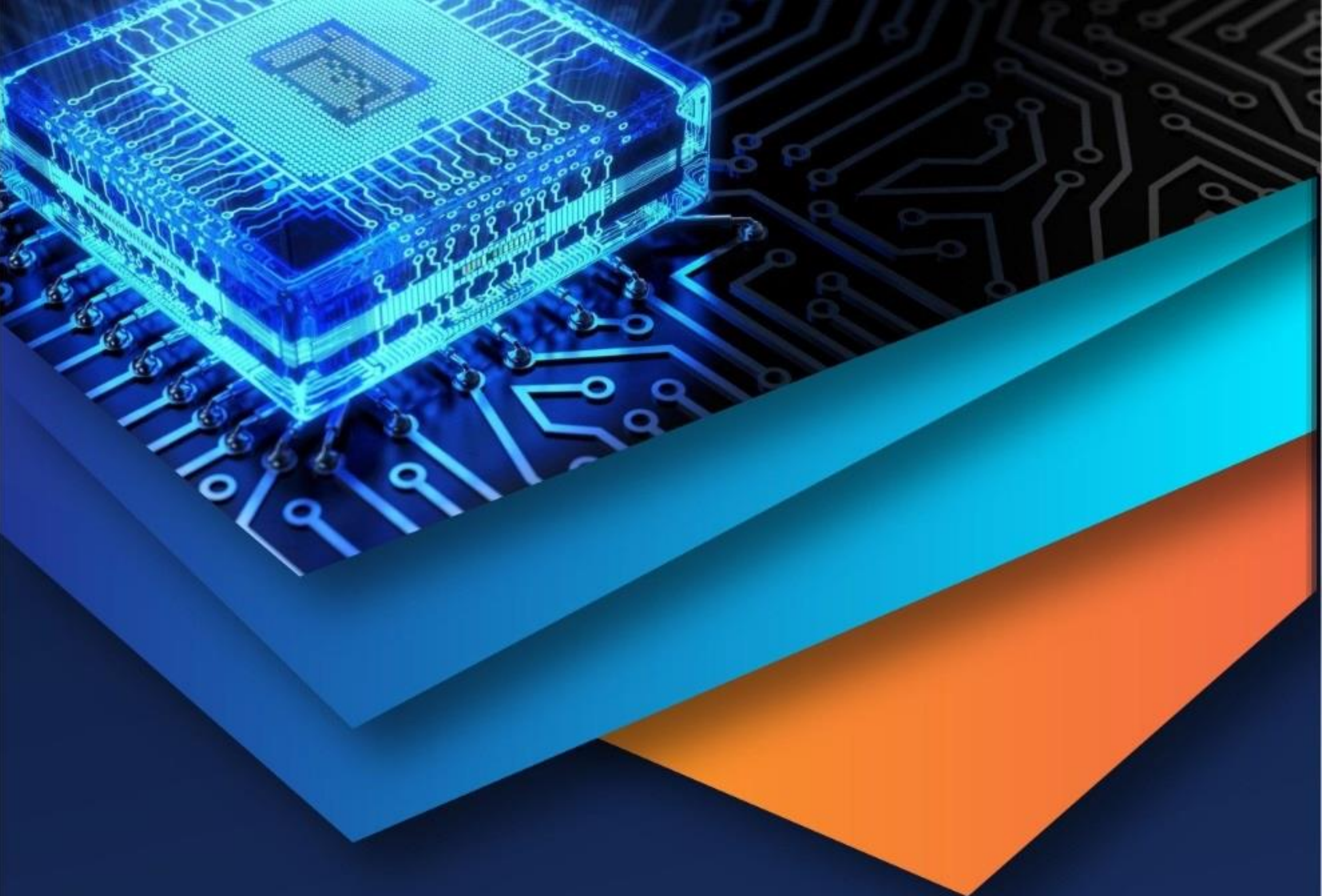
[11] Valery Naumov, Rainer Baumann, Thomas Gross, "An Evaluation of Inter-Vehicle Ad Hoc Networks Based on Realistic Vehicular Traces", *in Proceedings of MobiHoc'06, 2006, pp. 108-119*.

[12] Q.Yang, A.Lim, S.Li, J.Fang, P.Agrawal, "ACAR: adaptive connectivity aware routing for vehicular ad hoc networks in city scenarios", *Mobile Networks and Applications*, vol.15(1), 2010, pp.36-60.

[13] J.Zhao, G.Cao," VADD: vehicle-assisted data delivery in vehicular ad hoc networks", *in Proceedings of INFOCOM*, 2006, pp.1-12.

[14] E.W.Dijkstra, "A note on two problems in connexion with graphs", Numerische mathematik, 1959, pp.269-271.

[15] V. Namboodiri, L. Gao, "Prediction-based routing for vehicular ad hoc networks", *Vehicular Technology, IEEE Transaction*, vol.56, 2007, pp.2332-2345.



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY