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SMART CITY ROAD PERCEPTION BASED GEOGRAPHICAL ROUTING PROTOCOL ALGORITHM FOR URBAN VEHICULAR NETWORKS

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ABSTRACT

High vehicular mobility causes frequent changes in the density of vehicles, discontinuity in inter-vehicle communication, and constraints for routing protocols in vehicular ad hoc networks (VANETs). The routing must avoid forwarding packets through segments with low network density and high scale of network disconnections that may result in packet loss, delays, and increased communication overhead in route recovery. Therefore, both traffic and segment status must be considered. This paper presents real-time intersection-based segment aware routing (RTISAR), an intersection-based segment aware algorithm for geographic routing in VANETs. This routing algorithm provides an optimal route for forwarding the data packets toward their destination by considering the traffic segment status when choosing the next intersection. RTISAR presents a new formula for assessing segment status based on connectivity, density, load segment, and cumulative distance toward the destination. A verity period mechanism is proposed to denote the projected period when a network failure is likely to occur in a particular segment.

1. INTRODUTION

Previous researchers consider vehicular ad hoc networks (VANETs) that facilitate ubiquitous connectivity between vehicles and do not rely on expensive network infrastructure. Communication between vehicles and preexisting infrastructure opens up a plethora of different types of promising applications for passengers and drivers. These applications provide safety and comfort and assist drivers to be alert in order to avoid any accident, traffic jam, unseen obstacles, speed violation, internet access, weather information, multimedia services, and so forth. Although being a subclass of mobile ad hoc networks a vehicular network has several unique properties that distinguish it from other ad hoc networks. The most significant differences are high mobility pattern, rapid changing, and dynamic topology which lead to high network partition and disconnectivity in network. However, dynamic topologies are not completely random and movement of nodes is restricted with roads and relatively predictable. The predictability is important factor for link selection but linear topology reduces the possible path redundancy. Another representative characteristic is the impact of obstacles on the communication quality in urban environment in the shapes of trees, buildings, and so forth. Efficient data routing is considered as essential for practicability of these aforementioned applications. One of the main issues in routing protocols is the absence of end-to-end path from source to the destination. To address this diversity many routing protocols employ extensive approaches to flood the network with data packets. The success of routing revolves around various key factors and without an appropriate routing strategy it will continue to be limited.

2. RELATED WORK

Wide spectrum of different applications is relying on efficient packet routing to enhance the safety and provide comfortable driving environment. A wide range of routing protocols have been proposed to cope with sparse and highly mobile vehicular network and broadly grouped into different types such as topology, recast, cluster, and geographical or position based routing protocols. Geographical routing protocols establish revived interest in mobile and vehicular networks [1]. In geographical routing, the packet forwarding decisions are based on position of direct neighbors and destination node. These protocols were primitively designed in 1987 for packet radio networks or for mobile networks [2] and cannot be mapped directly to vehicular networks. One of the main reasons behind this phenomenon is that the movement of vehicles reserved by roads and paths is allowed by the scenario. Because of vehicle density on the roads, the routing protocols must utilize localized information to attain the scalability requirements in the network. As a result, the vehicle nodes forward the packets with the help of local information provided through nearby direct neighbors. This process leads to less control overhead because of the suppression of the vehicle node information of other parts of network. The Greedy Perimeter Stateless Routing (GPSR) [3] protocol was proposed in 2000 for wireless datagram network. It utilizes the position of vehicles and destination node during the process of packet forwarding. The protocol has two principles for packet forwarding: greedy and perimeter forwarding. The greedy mode is used for the selection of neighbor node which is closer to the destination. If the intermediate node has no other neighbor nodes near the destination node, it enters into local maximum. The local maximum issue in network protocol can be addressed by switching by perimeter mode for recovery. The protocol performance is better in open space scenarios due to less obstacles attributed. On the other hand, in city environment protocol suffered from degradation due to restriction owing to obstacles. The longer paths lead to higher delay and routing loops in network. The successor of GPSR is GPCR [4], proposed in 2005 with the concepts of restricted greedy and perimeter forwarding modes. The concept of restricted greedy mode selects the neighbor node which is the closest distance to the destination. In perimeter mode, the protocol uses right hand rule to forward packets to the next neighbor node and assumes the road traffic as planner graph. GSR [5] integrates geographical routing supported by city maps. In the case of source and destination position, the city map is given. It determines the number of junctions with the help of Dijkstra algorithm to find the shortest possible route toward the destination. Then protocol utilizes greedy approach and packet carrier node to select the candidate node closer to the next intersection.

3. SYSTEM MODELS

3.1.1 Routing Protocol

Basically in these protocols the packets are forwarded to all the vehicle nodes within specified geographical area which leads to looping and network overhead issues in network. A node has a set of one-hop neighbor nodes within transmission range that checks the optimal forwarding node with different strategies. These vehicle nodes are moving randomly and frequently change their position. Each vehicle node periodically broadcasts the beacon messages to know the mobility characteristics and obtain the information of each other.

3.1.2 Proposed Routing Protocol Packet Forwarding

Vehicular ad hoc networks (VANETs) have earned a gigantic consideration in the recent era. Wide deployment of VANETs for enhancing traffic safety, traffic management, and assisting drivers through elegant transportation system is facing several research challenges that need to be addressed. One of the critical issues consists of the design of scalable routing algorithms that are robust to rapid topology changes and recurrent link disconnections caused by the high mobility of vehicles. In this article, first of all give a detailed technical analysis, comparison, and drawbacks of the existing state-of-the-art routing protocols. Then propose a novel routing scheme called a Reliable Path collection and Packet Forwarding Routing Protocol (RPSPF). The originality of our protocol comes from the fact that firstly it establishes an optimal route for vehicles to send packets towards their respective destinations by considering connectivity and the shortest optimal distance based on multiple intersections. Secondly, it uses a novel reliable packet forwarding technique in-between intersections that avoids packet loss while forwarding packet due to the incidence of sudden link ruptures. The performance of the protocol is assessed through computer simulations.

3.1.3. Routing Metrics between Intersection

A) Distance and Direction.

The distance and direction are considered to be very important parameters because in transmission range of vehicle node there is a possibility that two nodes are very close to each other or they are alienated through a distance of maximum radio range. The shorter distance of vehicle nodes leads to high number of hops and nearest nodes can generate higher interface in network. If source node selects the closer node with maximum radio range the possibility of link failure increases because of high signal reduction of unreliable wireless channels. The selection of outmost and tremendous end of transmission range nodes may have advanced probability to exit on or after radio range and plunge the packets.

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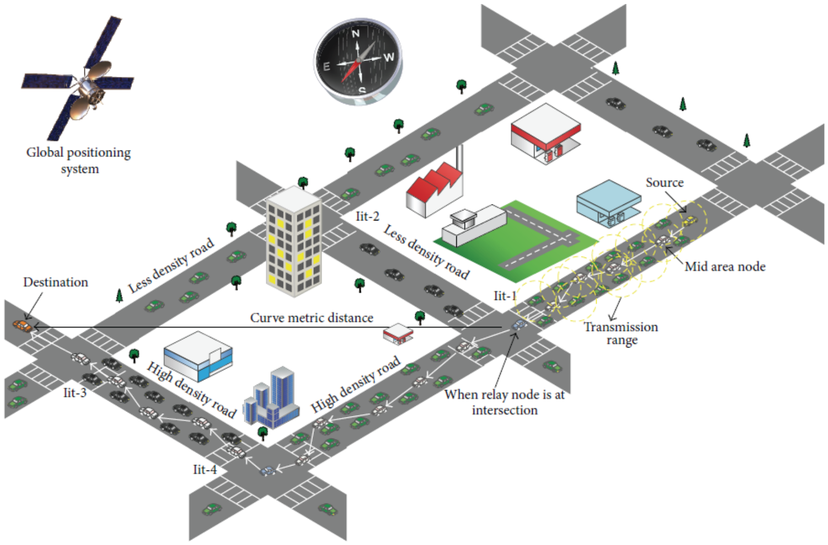

Figure 1: Road perception based geographical routing protocol (RPGR) operation between intersections and at intersection.

It adopts vehicle density on every road to avoid sparse connectivity. The third protocol SDR uses direction and path duration prediction to select next hop in network. The proposed RPGR also uses midrange node, link quality and direction as routing metrics to select next hop or route in network. The performance of the proposed direction-finding protocol is evaluated by packet delivery ratio, end-to-end delay, average path length, and different data packet sizes. The elaborate description of these metrics is as follows:

(i) Packet delivery ratio (PDR) is defined as portion of successfully received data packets at the destination over the total sending packets from source side. This metric shows the ability of routing protocol to successfully transmit data from source to destination in network.

(ii) The end-to-end delay is defined as total time of transferring data from source node to destination. Basically the packet delay is a sum of sending buffer, retransmission, medium access delay due to interface queue, propagation delay, and relay election delay.

(iii) The average path length is defined as an average number of nodes during transmission of data packets between source and destination. This metric also Demonstrates the path quality

B) Simulation Results

The proposed routing protocol is evaluated with different parameters. By varying the different parameters, various experiments are conducted such as the impact of density, vehicle velocity, different number of source nodes in network, and different data packet sizes. The comparison study is based on the proposed routing protocol and state of the art of the existing three geographical routing protocols.

C) Traffic Density Analysis

The simulation results show the positive traffic density analysis of RPGR compared to other state of the art routing protocols. In these experiments, the vehicle traffic varies from100 to 350 nodes. RPGR outperforms in terms of data delivery in medium and dense environment compared with other state-of-the-art routing protocols.

4. CONCLUSION

This paper has presented the road perception biological routing protocol (RPGR) for packet forwarding in VANET for urban based environment. The protocol takes advantage of the road layout to perform the requirement of efficient routing. The RPGR considers distance, direction and mid section node to reactively select the next intersection. Whenever the forwarder node is at the intersection, curve metric direction and high traffic density are rechecked and forward the data toward destination in the network. The performance of the proposed routing protocol has been analyzed in simulation with three existing CMGR, Geo SVR, and SDR routing protocols. The results demonstrate worse performance of RPGR in terms of packet delivery ratio average packet delay and average path length with different vehicle density and packet size. The results also prove that the proposed protocol is a realistic solution for urban area.

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